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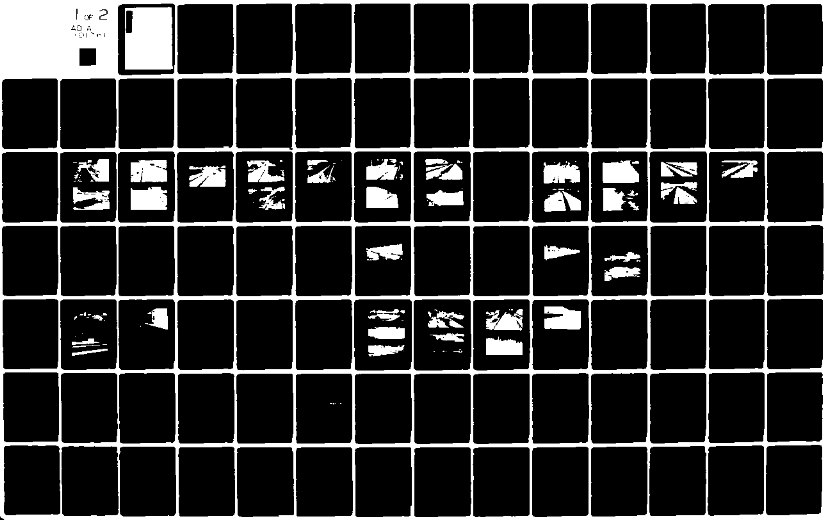

MTMC REPORT TE 78-25

RAIL AND MOTOR OUTLOADING CAPABILITY STUDY

FORT LEWIS, WASHINGTON

September 1978

Project Engineer

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MILITARY TRAFFIC MANAGEMENT COMMAND

TRANSPORTATION ENGINEERING AGENCY

Newport News, Virginia 23606

TABLE OF CONTENTS

		Page
	LIST OF ILLUSTRATIONS	v
	LIST OF TABLES	viii
	EXECUTIVE SUMMARY	1
I.	INTRODUCTION	7
II.	ANALYSIS OF FORT LEWIS' RAIL OUTLOADING FACILITIES	12
	A. General	12
	B. Rail Facility Description	12
	C. Current Procedures	33
	D. Rail System Analysis	34
	1. Current Outloading Capability	34
	2. Rail Outloading Analysis	34
	3. Rail System Outloading Options	38
	4. Physical Improvements and Additions	40
	5. Discussion of Time and Costs	40
III.	ANALYSIS OF COMMERCIAL RAIL FACILITIES WITHIN THE TACOMA AREA	51
IV.	SPECIAL EQUIPMENT FOR EXPEDITING THE OUTLOADING OF MILVANS	54
V.	ANALYSIS OF MOTOR SYSTEM OUTLOADING CAPABILITY	55
	A. General	55
	B. Motor Loading Facilities	55
	C. Flatbed Semitrailer Outloading	60

TABLE OF CONTENTS - cont

		Page
	D. Van Semitrailer Outloading	61
VI.	CONCLUSIONS	62
VII.	RECOMMENDATIONS	64
	APPENDIXES	
	A - Track Safety Standards	65
	B - Proposed Rail Outloading Procedure for a Mobilization Move at Fort Lewis	77
	C - Special-Purpose Railcars and Loading/Unloading Procedures	87
	D - Cost Estimate	91
	DISTRIBUTION	92

LIST OF ILUSTRATIONS

Figure		Page
1	Fort Lewis and vicinity	9
2	Fort Lewis Main Post rail system	13
3	Fort Lewis Logistics Center rail system	15
4	North Fort Lewis rail system	17
5	Concrete end-loading ramp, track 6A	22
6	Concrete ramp at track 6B	22
7	Concrete end-loading ramp, track 6	23
8	Side ramp at track 6	23
9	Concrete end ramp at track 5	24
10	Concrete end-loading ramp, track 4	25
11	Side ramp at track 4	25
12	Track 3 (looking west)	26
13	Tracks 2 (left) and 1 (right) (looking east from 9th Division Street)	27
14	Tracks 1 (left) and 2 (right)(looking west from 9th Division Street)	27
15	Tracks 2 (left), 1 (center), and 5 (right)(looking west)	28
16	Concrete end-loading ramp, track 11	28
17	Concrete end ramp at tracks 9 (left) and 10 (right)	30
18	Tracks 10 (left) and 9 (right) (looking east)	30
19	Track 12 (looking west)	31

LIST OF ILLUSTRATIONS - cont

Figure		Page
20	Concrete end ramp at tracks 5 (left) and 6 (right) . . .	31
21	Tracks 1 (left), 2 (center), and 3 (right) with staging area	32
22	Tracks 10, 5, 13, 14, 15, and 16 (left to right) (looking northeast)	32
23	Fort Lewis Logistics Center interchange yard (tracks 10, 5, 13, 14, 15, and 16 left to right) (looking northeast)	33
24	Fort Lewis rail system outloading options	39
25	Circus-style loading of 2-1/2-ton trucks	41
26	Lower level of bilevel cars loaded with jeeps, gama goats, 3/4-ton trucks, and 1-1/4-ton trucks	45
27	Administrative loading, mules	46
28	Administrative loading, 1/4-ton trailers	46
29	Timber end ramp, BN yard, Tacoma	52
30	Concrete end ramp, UP yard, Tacoma	52
31	Double concrete end ramp, UP yard, Tacoma	53
32	Timber and earth ramp between tracks 3 and 4 (Main Post)	57
33	Timber and earth ramp north of track 12 (Logistics Center)	57
34	Concrete ramp near South L Street and Rainier Avenue (Logistics Center)	57
35	Concrete end ramp at tracks 2 and 3 (Logistics Center) .	58

LIST OF ILLUSTRATIONS - cont

Figure		Page
36	Concrete end ramps at tracks D and E (North Ft Lewis) .	58
37	Concrete side ramp at track A (North Ft Lewis) . . .	59
38	Bilevel/trilevel ramp	59
39	Loading dock adjacent to warehouse 9665, Logistics Center	60
40	Rail outloading simulation, Main Post, Plan 5	78
41	Rail outloading simulation, Logistics Center, Plan 5 . .	82

LIST OF TABLES

Table		Page
1	Rail and Motor Outloading Capability	3
2	Fort Lewis Rail Outloading Facilities	18
3	Times Required to Perform Various Loading Functions . .	36
4	Typical Site Loading and Blocking and Bracing Times (Total)	43
5	Cost Comparison, Bilevel Versus 54-Foot Flatcars . .	49
6	Railroad Facilities Within the Tacoma Area	51
7	Vehicle End-Loading Ramps	56
8	Trailer Train Company Fleet	89

EXECUTIVE SUMMARY

1. SCOPE

The Military Traffic Management Command (MTMC) conducted a survey of the rail and motor facilities at Fort Lewis, Washington, from 6 through 10 February 1978, to determine the installation's outloading capability. Rail facilities within the Tacoma area were included in the survey.

2. FINDINGS

The primary finding is that Fort Lewis has the potential capability to support relatively large-scale rail outloading operations.

Fort Lewis' primary port of embarkation (POE) is somewhere on the east coast; therefore, all unit equipment should be moved to the POE by rail. To transport the equipment of the division and its support units, 2,997 railcars would be required, with an estimated composition of 2,800 flatcars (2,530 contain roadable and 270 contain non-roadable equipment) and 197 boxcars.[1/] Since the installation's outloading plans were incomplete and no time frame had been established for unit outloading, the analyses in this report are based on a 10-day outloading operation.

Fort Lewis has three separate rail facilities without connecting Government trackage (Fort Lewis Main Post has 10-1/2 miles of track; Logistics Center has 12-1/2 miles of track, and North Fort Lewis has 7 miles of track). The Burlington Northern (BN) serves all three areas, and the Union Pacific (UP) serves only North Fort Lewis and Main Post. The Fort Lewis tracks are basically in good condition; however, preventive maintenance is needed. There are rail facilities that would be suitable to support Fort Lewis' outloading operations in the Tacoma area, about 10 miles from Fort Lewis.

The current rail outloading capability at Fort Lewis is limited not by physical attributes of the rail systems but by shortages of small handtools, bridgeplates, and blocking and bracing materials.

1/ Since most flatcars are 57 feet long (coupler to coupler), that length is used in this report; to convert to any other length, simply multiply the number of cars by 57 and divide by the desired length.

Currently, using only selected rail outloading sites at Fort Lewis Main Post and the Logistics Center, approximately 300 railcars per day could be outloaded. This outloading rate would meet the requirement to outload the division and its support units within approximately 10 days. However, the current supply of blocking and bracing materials is sufficient for about 15 percent of the requirement (450 railcars). Also needed for maximum efficient outloading operations are adequately trained blocking and bracing crews, as well as completed outloading plans.

It should be noted that the physical rail system outloading capability at Fort Lewis is greater than 300 railcars per 24-hour day, but that this figure was used for the following reasons:

a. It meets the MTMC-PLM parameters to outload the division and its support units within 10 days.

b. It is the most cost-effective plan, since it allows for a minimum of installation trackage to be maintained and still meets the mobilization outloading requirement.

c. Acquiring large numbers of railcars (greater than 300 per day) and locomotives is difficult.

d. Recent historical data do not substantiate any rail outloading move of this magnitude (300 or more railcars per day).

The recommended plan, Plan 5, has a yield of 291 railcar loads per 24-hour period. Other options, producing 45, 99, 154, and 194 railcar loads, are presented in this study, but Plan 5 satisfies the requirement to outload the division and its support units within approximately 10 days.

A survey of loading ramps and other equipment suitable for loading semitrailers revealed that, although the actual availability of semitrailers cannot be predetermined, the motor outloading capability of Fort Lewis far exceeds the probable supply of available commercial trailers. However, because Fort Lewis' POE is somewhere on the east coast, all equipment should be moved by rail, and because its rail system is potentially capable of supporting major outloading operations, semitrailer outloading is not a significant consideration.

Table 1 shows the current and potential outloading capabilities (both rail and motor) of Fort Lewis.

TABLE 1
RAIL AND MOTOR OUTLOADING CAPABILITY

Rail				
	Number and Type of Railcars (57-ft Length, Coupler to Coupler)			
Rate	Flatcars	Boxcars	Total Outloading	Current Constraints
Daily Current	30	5	35	
Daily Mobilize	275	16	291[a]	Lack of blocking and bracing materials, small handtools, bridgeplates, outloading plans, trained blocking and bracing crews, and railcar availability.
Plan 5	275	16	291	Same.

Motor				
	Number of Trailers at Available Facilities			
Rate	Flats	Van Semi-trailers	Total Outloading	Current Constraints
Daily Current:				
- Concurrent (with rail operation)	22	10	32	
- Separate (without rail operation)	35	20	55	
Daily Mobilize:				The probability of obtaining these numbers of flatbed and van semitrailers on a daily basis is remote.
- Concurrent (with rail operation)	170[b]	220[c]	390	
- Separate (without rail operation	350[d]	220[c]	570	

[a] Current supply of blocking and bracing materials adequate for only 450 railcars.
[b] With existing usable end-loading ramps and equipment suitable for end-loading semitrailers.
[c] Using warehouses 9630, 9660, 9665, and 9670 located at the Logistics Center.
[d] Using all of b above plus all existing usable rail end-loading ramps.

3. CONCLUSIONS

a. Because Fort Lewis' designated POE is on the east coast, all unit equipment should be outloaded by rail.

b. The Fort Lewis railroad tracks are in basically good condition. The primary constraint limiting its rail outloading capability is the shortage of blocking and bracing materials, small handtools, bridgeplates, and trained blocking and bracing crews.

c. After the deficiencies noted above are corrected and on receipt of a sufficient number of railcars to permit full-scale outloading, Fort Lewis could achieve an outloading rate of 291 railcars per 24-hour period. At this rate, the equipment of the division and its support units could be outloaded in approximately 10 days. (The nonroadable equipment could be outloaded in 1 day.)

d. No costs for track repairs were indicated since all selected tracks are currently in good condition and meet federal track safety standards, Class 2[2/]; however, maintenance is required periodically to insure continued effectiveness. Costs for needed handtools, bridgeplates, and blocking and bracing materials would be additional.

e. Empty railcars (dedicated train lengths) destined for Fort Lewis should be positioned, in trainloading sequence, in Tacoma.

f. The BN and UP representatives did not express any reservations regarding the outloading of Fort Lewis units concurrently with other commercial demands. However, Fort Lewis transportation personnel should coordinate planning of impending outloading operations with the BN and UP representatives at the earliest possible date.

g. The three Government-owned switching engines (two 80-ton and one 100-ton) would be required for shifting empty and loaded cars to produce an output of 291 railcars per 24-hour day. These engines are in addition to the locomotive power required to pick up five loaded trains per day.

[2/] AR 420-72, 24 March 1976, Surfaced Areas, Railroads, and Associated Structures, para 3-15a, states that track on military installations will be maintained to the minimum track safety standards required for Class 2 track as outlined in the current Department of Transportation Federal Railway Administration Track Safety Standards (app A).

h. For administrative-type moves, when leadtime is plentiful and costs must be considered, special-purpose railcars (such as bilevel autoracks, trailer-on-flatcar (TOFC), and container-on-flatcar (COFC) cars) are more cost-effective than the standard types and should be used to the extent they are available.

i. For mobilization moves, when time is more critical than costs, the use of special-purpose railcars may not be possible because of the short leadtime and the relatively short supply of these high-demand cars.

j. Most of Fort Lewis rail operations personnel are approaching retirement; therefore, if trainees are not hired, the capability of Fort Lewis to support rail outloadings will be lost in a few years.

k. For concurrent rail/motor operations, 170 flatbed and 220 van semitrailers could be loaded per 10-hour day (for daylight operations only), and for separate operations, 350 flatbed and 220 van semitrailers could be loaded during the same period. This capability far exceeds the likely available supply of semitrailers.

l. The maximum degree of curvature of the railroad tracks on Fort Lewis is 8 degrees at North Fort Lewis, 8 degrees 6 minutes at Main Post, and 6 degrees at the Logistics Center. Consequently, any known length railcar can be used on the installation.

4. RECOMMENDATIONS

a. Undertake those items listed in section II, paragraph D4, "Physical Improvements and Additions." These improvements will provide a rail system capability of 291 railcars per 24-hour day and will perpetuate an effective rail system.

b. Prepare a detailed unit outloading plan, using the simulation in appendix B as an example, that specifies unit assignments at loadout sites and movement functions.

c. Coordinate rail outloading plans with the BN and UP railroad representatives at the earliest possible date.

d. Continue rail facility maintenance to insure an effective rail system.

e. Provide advance training for blocking and bracing crews.

f. Retain the three Government-owned switching engines to support major outloading operations.

g. Station road guards at all railroad crossings during outloading operations, and provide all train crewmen with walkie-talkies to insure a safer and more efficient operation.

h. Hire trainees to replace locomotive crew members who are nearing retirement.

i. Keep abreast of the BN and UP railroad maintenance plans.

j. Use special-purpose railcars (such as bilevel autoracks for small vehicles, TOFC cars for semitrailers and vans, and COFC cars for MILVANs) for administrative-type moves and, as available, for mobilization moves.

k. Provide warehousing for the blocking, bracing, and small tool supplies.

l. Coordinate with MTMC any removal of railroad track that is included in the mobilization outloading plan.

m. Construct any new track with a maximum degree of curvature of 12 degrees.

I. INTRODUCTION

An onsite rail and motor outloading study of Fort Lewis, Washington (fig 1), was conducted by the Military Traffic Management Command Transportation Engineering Agency, Newport News, Virginia, during the period 6 through 10 February 1978. The principal objective of the study was to determine the capability of the Fort Lewis rail system to support the deployment of the 9th Infantry Division and its support units. Another objective was to identify any physical improvement, as well as any suitable commercial rail facilities within the Tacoma, Washington area, that would significantly increase the current capability.

The current rail outloading capability of Fort Lewis is limited by lack of outloading plans and inadequate blocking and bracing materials and hand-tools, as well as by inadequately trained blocking and bracing crews. The analyses in this study showed that, if these deficiencies were corrected, existing rail trackage and facilities could support an outloading rate of 291 railcars (daily mobilize) per 24-hour day. At this rate, the division and its support units could be outloaded in approximately 10 days. This study considers options that could produce 45, 99, 154, 194, or 291 loads per 24-hour period, but recommends the one with the 291 yield (Plan 5).

It should be noted that the physical rail system outloading capability at Fort Lewis is greater than 291 railcars per day; however, this figure was used for the following reasons:

a. It meets MTMC-PLM parameters to outload the division and its support units within 10 days.

b. It is the most cost-effective plan since it allows for maintaining the minimum amount of installation trackage and still meets the mobilization outloading requirement.

c. The questionable availability of larger numbers of railcars (more than 300 per day) and locomotives.

d. Lack of recent historical data to substantiate any rail outloading move of this magnitude (300 or more railcars per day).

Fort Lewis is served by the Burlington Northern (BN) and Union Pacific (UP) Railroads. There are suitable commercial rail outloading facilities within the Tacoma, Washington, area.

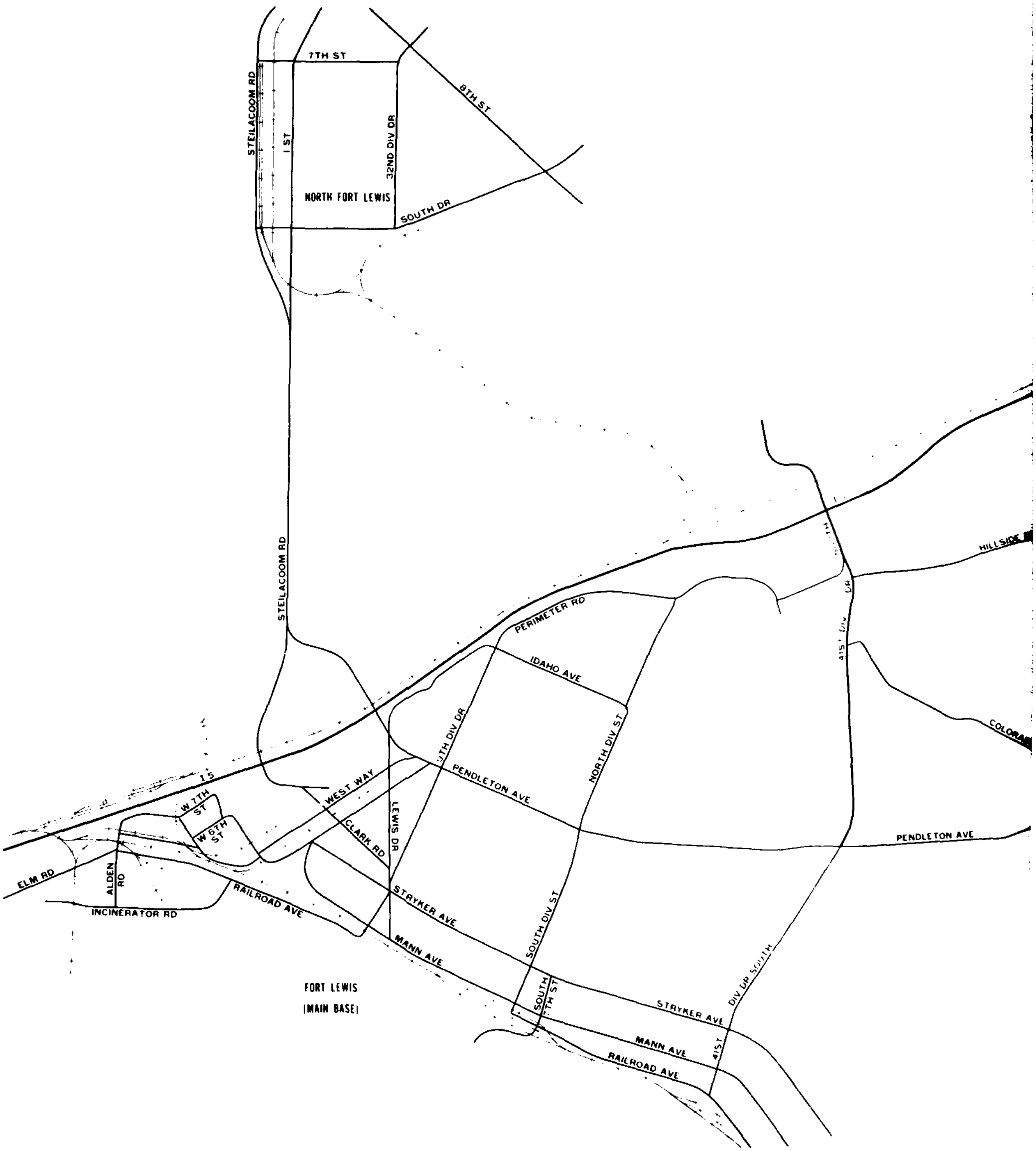
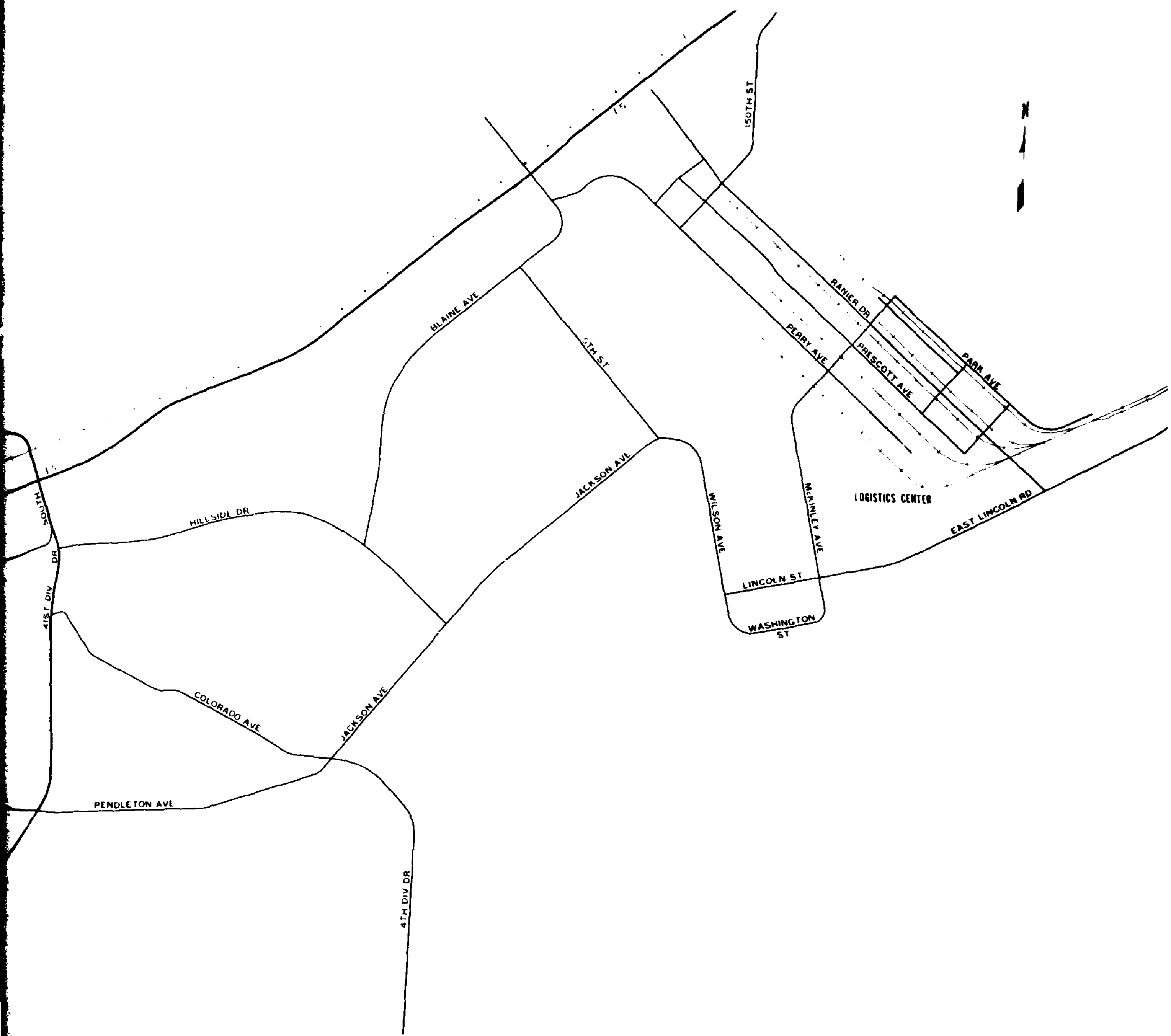


Figure 1. Fort Lewis and vicinity.


150TH ST
RANIER DR
PARK AVE
PRESCOTT AVE
PERRY AVE
BLAINE AVE
5TH ST
JACKSON AVE
WILSON AVE
McKINLEY AVE
LOGISTICS CENTER
EAST LINCOLN RD
LINCOLN ST
WASHINGTON ST
HILLSIDE DR
SOUTH
41ST DIV DR
COLORADO AVE
JACKSON AVE
PENDLETON AVE
4TH DIV DR
N

2

Motor outloading capability is not a significant consideration in this study, because Fort Lewis' POE is on the east coast.

Findings and recommendations contained in this report are based on analysis of data obtained during the field survey and on other pertinent information relating to installation activities at that time. Any problems incurred in implementing the recommendations should be referred to MTMCTEA for resolution.

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II. ANALYSIS OF FORT LEWIS' RAIL OUTLOADING FACILITIES

A. GENERAL

Discussions with personnel of the Transportation Office at Fort Lewis revealed that large-scale rail operations have occurred at the post in recent years. Factual data about locomotive operating times and switching operations were obtained from the installation's rail crew, which operates three Government-owned switching locomotives, two 80-ton and one 100-ton.

B. RAIL FACILITY DESCRIPTION

Fort Lewis has three separate rail facilities without connecting Government trackage. (Fort Lewis Main Post has 10-1/2 miles of track; Logistics Center has 12-1/2 miles of track; and North Fort Lewis has 7 miles of track.) These three rail areas are illustrated in figures 2, 3, and 4, and the facilities of each area and the purpose of each track are described in table 2. The survey of all sites that could be used for outloading equipment revealed that 18 sites currently have concrete end-loading ramps and that other sites have side-loading facilities as noted in table 2. Most railroad trackage at Fort Lewis is in good condition. The following discussion describes in detail the installation sites recommended for loading and for storage of loaded and empty railcars at Fort Lewis Main Post and the Logistics Center. The proposed loading sites at Fort Lewis Main Post, in descending order of preference, starting with L1 and going through L6, are:

Track 6A (L1) is a nine-railcar spur, with a concrete end-loading ramp. The staging area consists of a large graveled surface suitable for heavy tracked vehicles (fig 5).

Track 6B (L2), shown in figure 6, has a concrete end ramp and a 12-railcar capacity. The staging area for the site is large, graveled, and suitable for outloading heavy tracked vehicles.

Track 6 (L3) has concrete end- and side-loading ramps (figs 7 and 8). This rail spur can hold 24 railcars and has a graveled surface staging area. The side ramp could be used to outload two boxcars or trucks at a time.

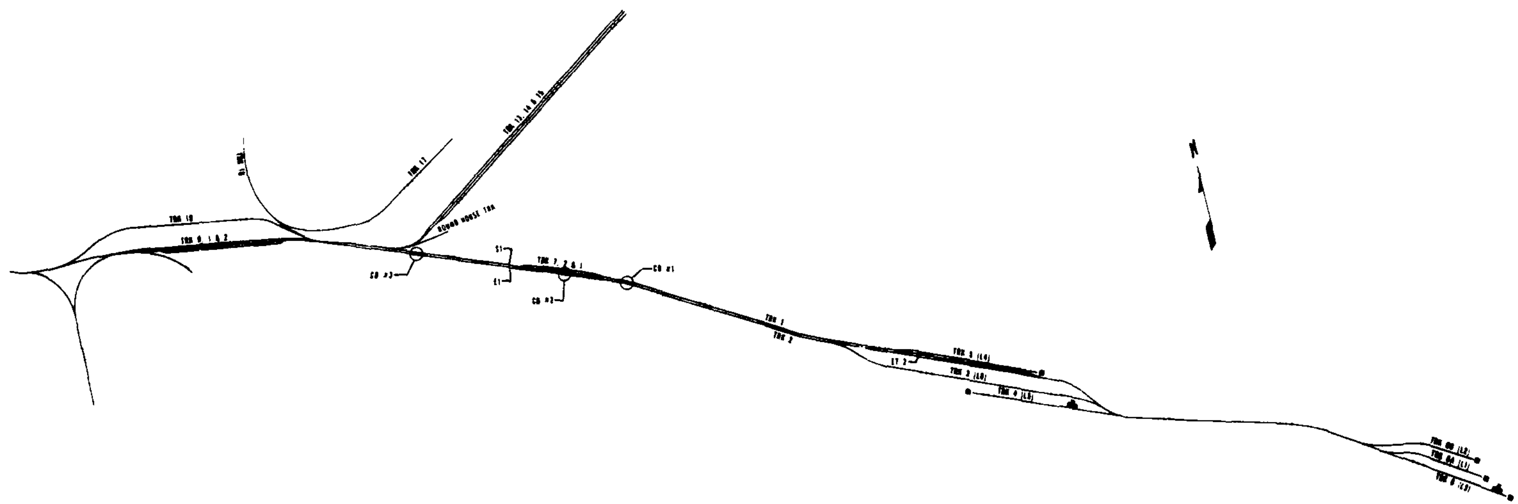


Figure 2. Fort Lewis Main Post rail system.

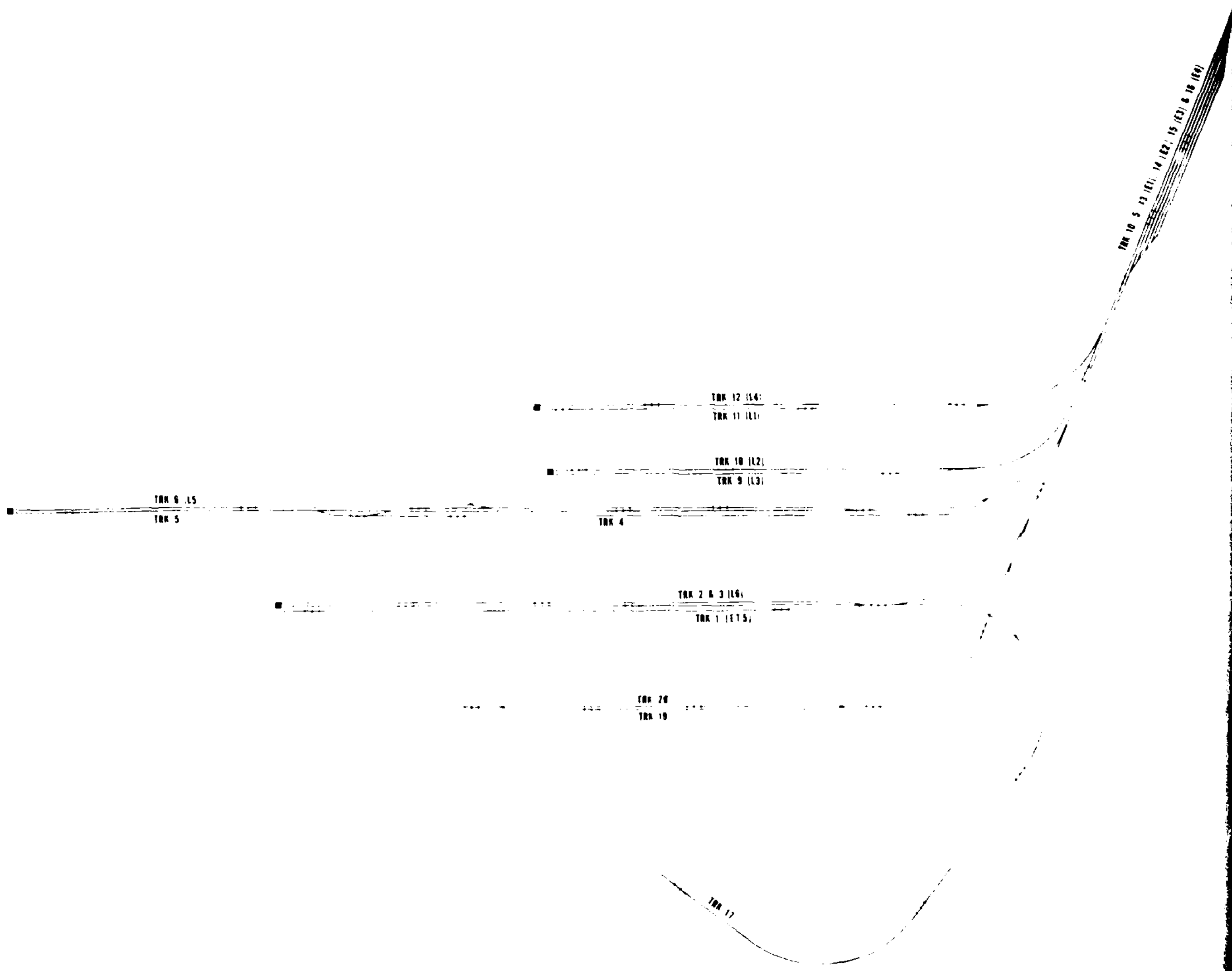
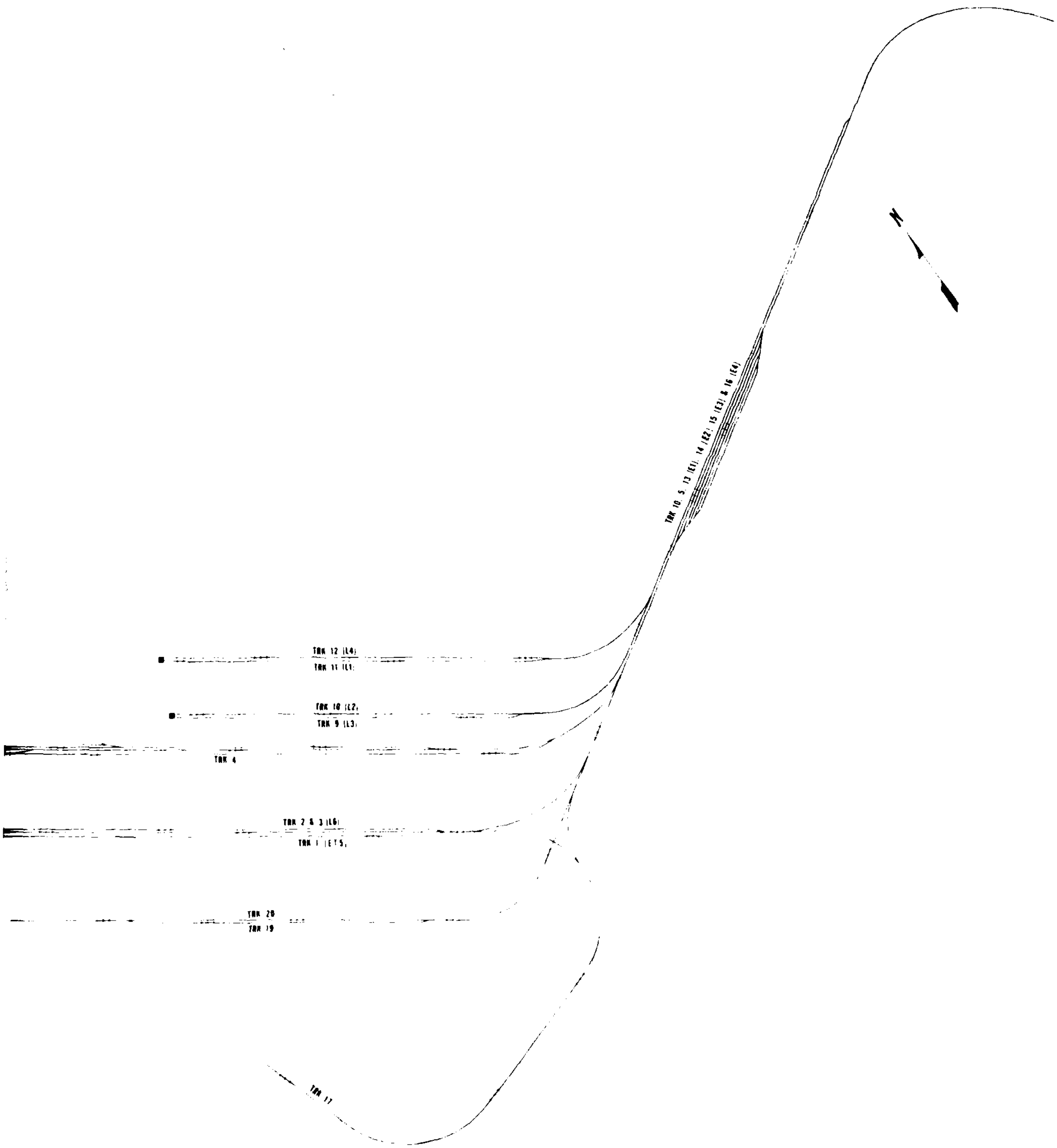


Figure 3. Fort Lewis Logistics Center rail system.



Lewis Logistics Center rail system.

2

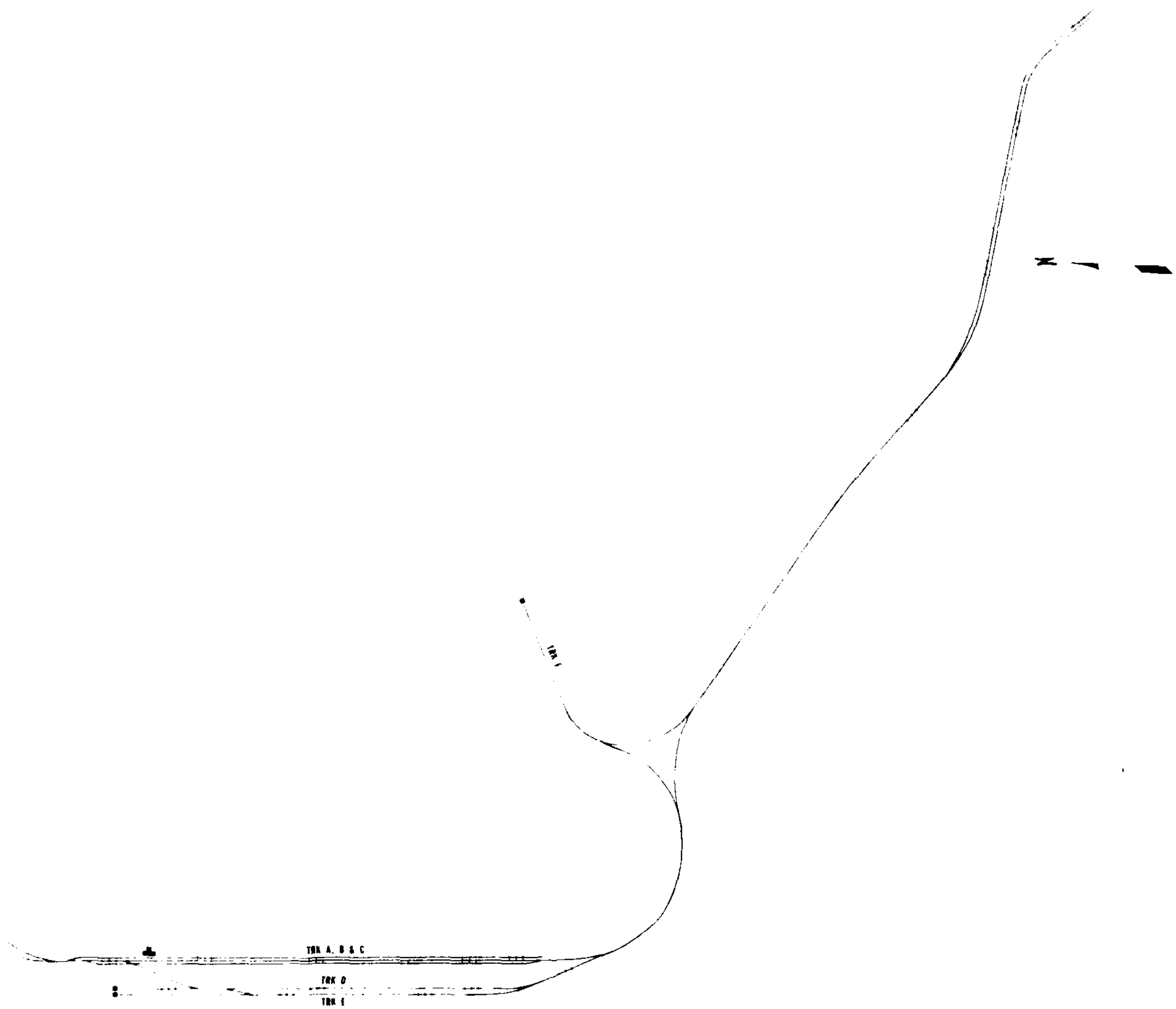


Figure 4. North Fort Lewis rail system.

TABLE 2
FORT LEWIS RAIL OUTLOADING FACILITIES

Fort Lewis Main Base										
Track and Figure No.	End Ramp	Lighting	Surface Condition	Staging Area	Railcar Capacity		Access Availability	Track Condition	Priority	Note
					Feet	Cars				
L1 (Track 6A, fig 5)	Yes, concrete	Some	Good	Yes, large	600	9	Good	Good	1 of 6	Outloading Tracked vehicles as needed
L2 (Track 6B, fig 6)	Yes, concrete	Some	Good	Yes, large	700	12	Good	Good	2 of 6	Outloading Tracked vehicles as needed
L3 (Track 6, figs 7 & 8)	End and side ramps, concrete	Some	Good gravel	Yes	1,370	24	Good	Good	3 of 6	Outloading Tracked vehicles, boxcars; also, truck-loading ramp, two trucks at a time.
L4 (Track 5, fig 9)	Yes, concrete	Some	Good	Yes	800	14	Good	Good	4 of 6	Outloading Wheeled or light tracked vehicles.
L5 (Track 4, figs 10 & 11)	End and side ramps, concrete	Some	Good	Yes	1,100	15	Good	Good	5 of 6	Outloading Wheeled, light tracked vehicles, also boxcars; truck-loading ramp, two trucks at a time.
L6 (Track 3, fig 12)	None	Some	Good	Yes	2,000	20	Good	Good	6 of 6	Outloading Wheeled or light tracked vehicles
S1 (Track 2 between round house track and track 5, figs 13 & 14	None	Some	Good	No	4,100	68	Good	Good	1 of 1	Loaded - storage

TABLE 2 - cont

Fort Lewis Main Base										
Track and Figure No.	End Ramp	Lighting	Surface Condition	Staging Area	Railcar Capacity		Access Availability	Track Condition	Priority	Note
					Feet	Cars				
E1 (Track 1 between round house track and Track 3, figs 13 & 14)	None	Some	Good	No	3,400	56	Good	Good	1 of 2	Empty storage
ET2 (Track 1 between track 3 and track 2, fig 15)	None	Some	Good	No	1,450	24	Good	Good	2 of 2	Temporary empty storage
Track 7	None	No	Good	No	700	11	Good	Good	NA	Warehouse tracks
Track 13 Track 14 Track 15	None None None	No No No	Good Good Good	No No No	2,100 2,100 1,900	35 35 31	Good Good Good	Good Good Good	NA NA NA	Warehouse tracks
Track 17	None	No	Good	No	NA	NA	Good	Good	NA	Service engineer equipment yard
Track 18	None	No	Good	Yes	700	12	Good	Good	NA	Accessible for loading gondolas with cranes
Track 10	None	No	Good	Yes	1,300	21	Good	Good	NA	Could be used for end loading with portable ramp
Track 9	None	No	Good	Yes	1,200	20	Good	Good	NA	Could be used for end loading with portable ramp

TABLE 2 - cont

Track and Figure No.	End Ramp	Lighting	Surface Condition	Staging Area	Railcar Capacity Feet	Railcar Capacity Cars	Access Availability	Track Condition	Priority	Note
Fort Lewis Main Base										
"Y"	None	No	Good	NA	NA	NA	Good	Fair	NA	Used for switching and turning cars.
Fort Lewis Logistics Center										
L1 (Track 11, fig 16)	Yes, concrete	No	Good	Yes, large	2,600	40	Good	Good	1 of 6	Outloading Tracked vehicles if needed
L2 (Track 10, figs 17 & 18	Yes, concrete	No	Good	Yes, large	2,500	40	Good	Good	2 of 6	Outloading Tracked vehicles as needed
L3 (Track 9, figs 17 & 18	Yes, concrete	No	Good	Yes, large	2,500	40	Good	Good	3 of 6	Outloading Tracked or wheeled vehicles
L4 (Track 12, fig 19)	No	No	Good	Yes, large	2,600	40	Good	Good	4 of 6	Outloading Wheeled or light tracked vehicles
L5 (Track 6, fig 20)	Yes, concrete	No	Good	Yes	4,800	80	Good	Good	5 of 6	Outloading Wheeled or light tracked vehicles
L6 (Track 3, fig 21)	Yes, concrete	No	Good	Yes	3,400	56	Good	Good	6 of 6	Accessible for loading MILVANs, CONEX, gondolas and boxcars
E1 (Track 13, figs 22 & 23)	No	No	Good	No	1,350	22	Good	Good	1 of 5	Empty storage
E2 (Track 14, figs 22 & 23)	No	No	Good	No	1,250	20	Good	Good	2 of 5	Empty storage
E3 (Track 15, figs 22 & 23)	No	No	Good	No	1,100	18	Good	Good	3 of 5	Empty storage
E4 (Track 16, figs 22 & 23)	No	No	Good	No	1,100	18	Good	Good	4 of 5	Empty storage
ET5 (Track 1, fig 21)	No	No	Good	No	3,400	56	Good	Good	5 of 5	Temporary empty storage
Track 5	Yes, concrete	No	Good	Yes	4,800	80	Good	Good	NA	Could be used for end loading

TABLE 2 - cont

Track and Figure No.	End Ramp	Lighting	Surface Condition	Staging Area	Railcar Capacity		Access Availability	Track Condition	Priority	Note
					Feet	Cars				
Fort Lewis Logistics Center										
Track 4	No	No	Good	No	3,900	65	Good	Good	NA	Warehouse track
Track 2	Yes, concrete	No	Good	No	3,400	56	Good	Good	NA	Could be used for end loading
Track 20	No	No	Good	Yes	2,900	48	Good	Good	NA	Warehouse track
Track 19	No	No	Good	Yes	1,800	30	Good	Good	NA	Could be used for end loading with portable ramp
Track 10	Side ramp	No	Good	Yes	3,500	58	Good	Good	NA	Could be used for boxcar loading
Track 5 (Main line)	No	No	Good	NA	NA	NA	Good	Good	NA	Main or running track
North Fort Lewis										
Track A	Side ramp	No	Good	Yes	2,700	45	Good	Good	NA	Could be used for either boxcars or truck loading
Track B	No	No	Good	Yes	2,700	45	Good	Good	NA	Warehouse track
Track C	No	No	Good	Yes	2,700	45	Good	Good	NA	Warehouse track
Track D	Yes, concrete	No	Good	Yes	2,500	43	Good	Good	NA	Could be used for end loading
Track E	Yes, concrete	Some	Good	Yes	2,500	43	Good	Good	NA	Could be used for end loading
Track F	Yes, concrete	No	Good	Yes	1,000	17	Good	Good	NA	National Guard unloading track

Figure 5. Concrete end-loading ramp, track 6A.

Figure 6. Concrete ramp at track 6B.

Figure 7. Concrete end-loading ramp, track 6.

Figure 8. Side ramp at track 6.

Track 5 (L4) is a 14-railcar spur, with a concrete end-loading ramp. The staging area is adequate to support the outloading operation (fig 9).

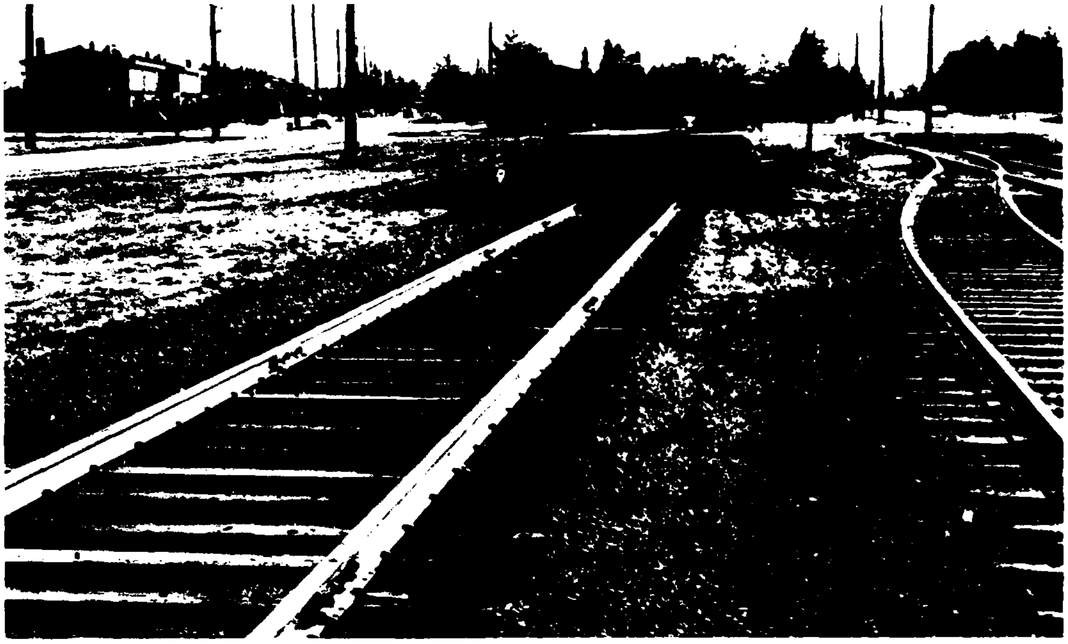


Figure 9. Concrete end ramp at track 5.

Track 4 (L5) has concrete end- and side-loading ramps (figs 10 and 11). The rail spur can hold 15 railcars and has a graveled surface staging area. The end ramp is suitable for outloading wheeled or light tracked vehicles, and the side ramp is suitable for outloading boxcars or trucks.

Track 3 (L6) could be used to outload wheeled and light tracked vehicles with the installation of a portable end ramp. The rail spur has a holding capacity of 20 railcars and is supported by a large graveled staging area (fig 12).

Certain tracks have been designated for either loaded or empty railcar storage at Fort Lewis Main Post. Track S1 will be used for loaded storage, and track E1 will be used for empty storage. Track ET2 is recommended for temporary empty storage. The following is a discussion of the storage track sites.

Figure 10. Concrete end-loading ramp, track 4.

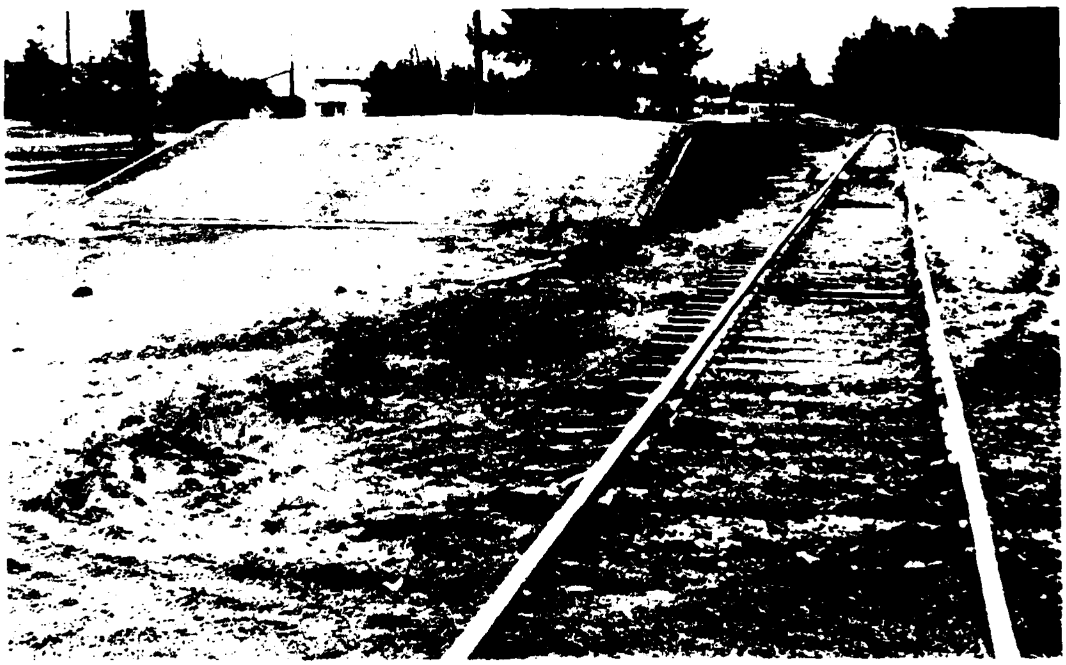


Figure 11. Side ramp at track 4.

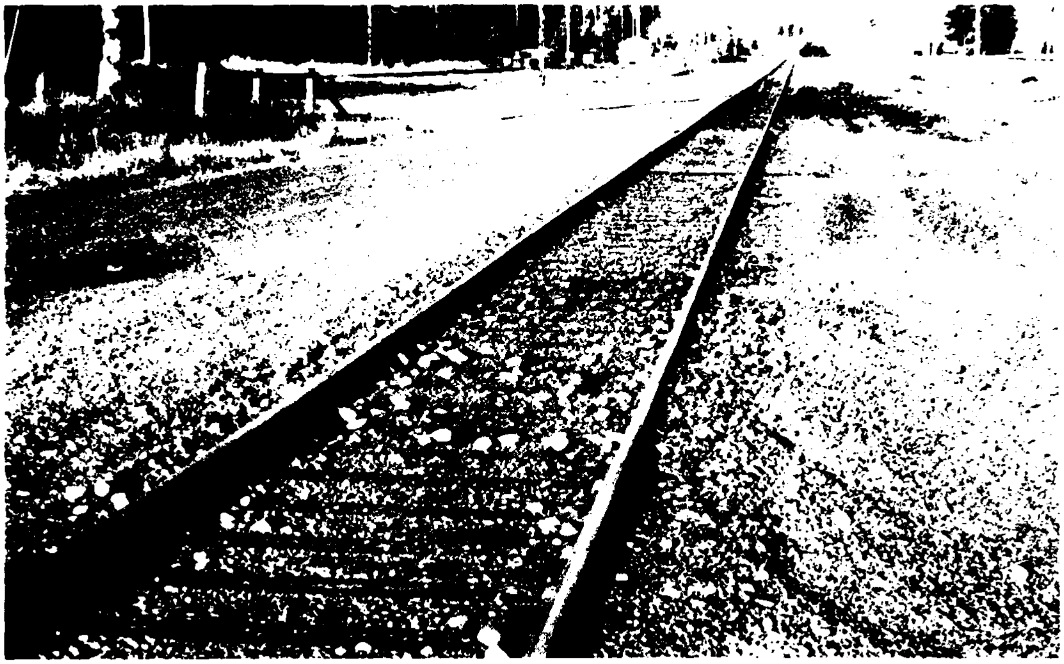


Figure 12. Track 3 (looking west).

Outbound track 2 (S1) is located on a section of track 2 between the roundhouse track and track 5. The holding capacity of this section of track is about 68 railcars, figures 13 and 14.

Inbound track 1 (E1) is located on a section of track 1 between the roundhouse track and track 3. The holding capacity of this section of track is approximately 56 railcars (figs 13 and 14).

Temporary storage track 1 (ET2) is located on a section of track 1 between tracks 2 and 3 (fig 15). The temporary storage capacity of this section of track is about 24 railcars.

The proposed loading sites at Fort Lewis Logistics Center, in order of preference, starting with L1 and going through L6, are:

Track 11 (L1) is a 40-railcar spur, south of and parallel to Park Avenue, with a concrete end-loading ramp. The staging area consists of a large graveled surface suitable for heavy tracked vehicles (fig 16).

Figure 13. Tracks 2 (left) and 1 (right) (looking east from 9th Division Street).

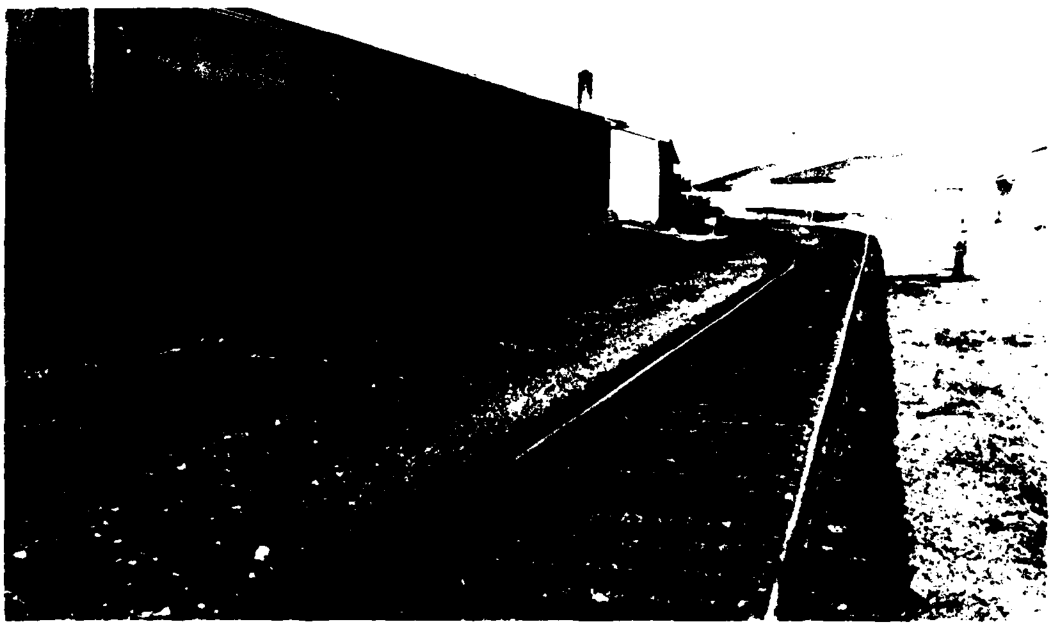


Figure 14. Tracks 1 (left) and 2 (right) (looking west from 9th Division Street).

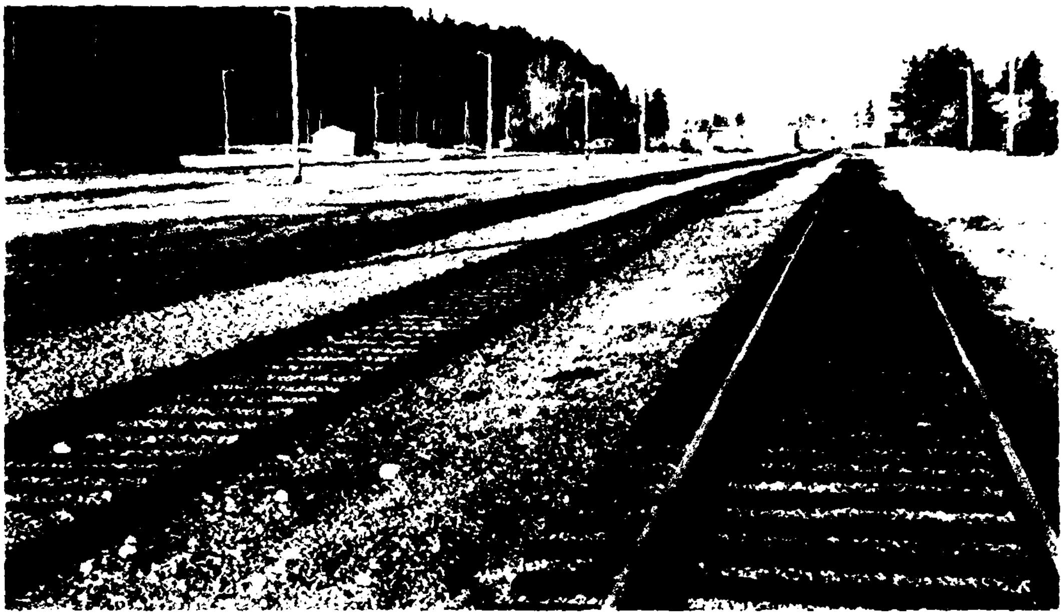


Figure 15. Tracks 2 (left), 1 (center), and 5 (right) (looking west).

Figure 16. Concrete end-loading ramp, track 11.

Track 10 (L2) is located north of and parallel to Rainier Drive. The spur is serviced by a concrete end ramp and has a 40-railcar holding capacity. The staging area for the site is large, graveled, and suitable for outloading heavy tracked vehicles (figs 17 and 18).

Track 9 (L3) has a concrete end-loading ramp (figs 17 and 18). The rail site can hold 40 railcars and has a large graveled staging area.

Track 12 (L4) could be used to outload wheeled and light tracked vehicles with the installation of a portable end ramp (fig 19). The rail spur has a 40-car capacity and is supported by a large graveled staging area.

Track 6 (L5), which terminates at a concrete end ramp, is capable of loading 25 railcars with light tracked or wheeled vehicles. The staging area at the site is adequate with good graveled surface conditions (fig 20).

Track 3 (L6) is used for side-ramp loading with a capacity of 12 railcars. The staging area is large and has a paved surface (fig 21). This site is accessible for loading MILVANs, CONEXs, gondolas, and boxcars.

Certain tracks at Fort Lewis Logistics Center have been designated for empty railcar storage and have been assigned a sequence rating ranging from one to five. Tracks E1, E2, E3, and E4 will be used only for empty storage. Track ET5 is recommended for temporary empty storage.

The loading sites previously discussed have the dual function of providing the loaded storage also. This is possible at the Logistics Center because of the high railcar capacity of the loading sites and the short distance between the interchange yard (empty storage) and the loading sites.

The following is a discussion of the empty storage track sites:

Tracks 13 (E1), 14 (E2), 15 (E3), and 16 (E4) in the Logistics Center interchange yard are suitable for storage of 22, 20, 18, and 18 railcars, respectively (figs 22 and 23).

Track 1 (ET5) can provide temporary storage for 56 cars (fig 21).

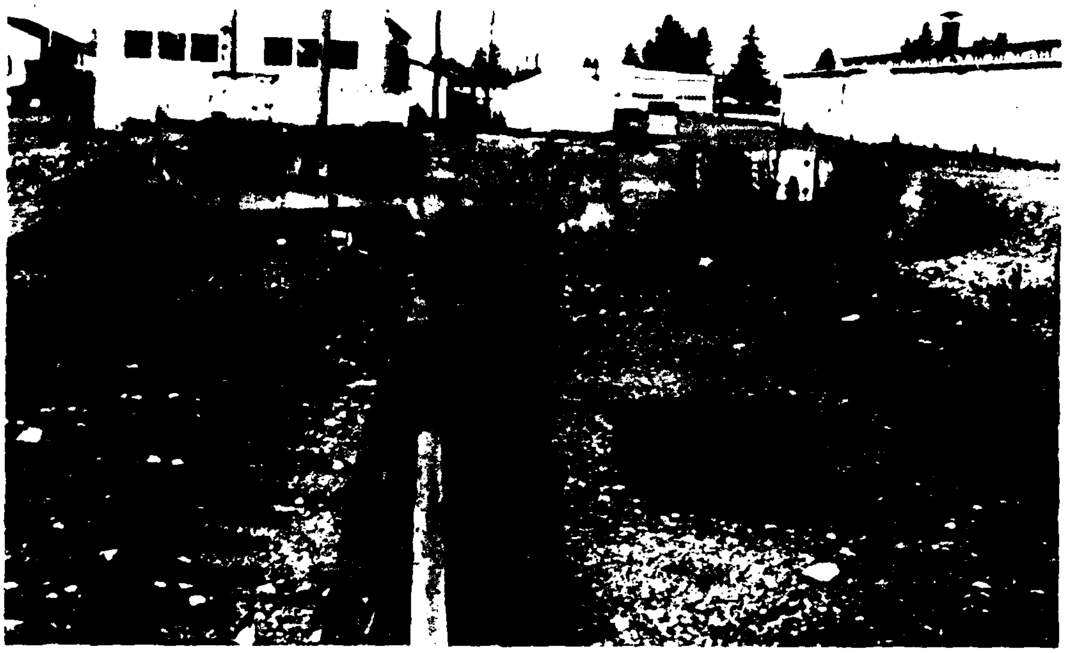


Figure 17. Concrete end ramp at tracks 9 (left) and 10 (right).

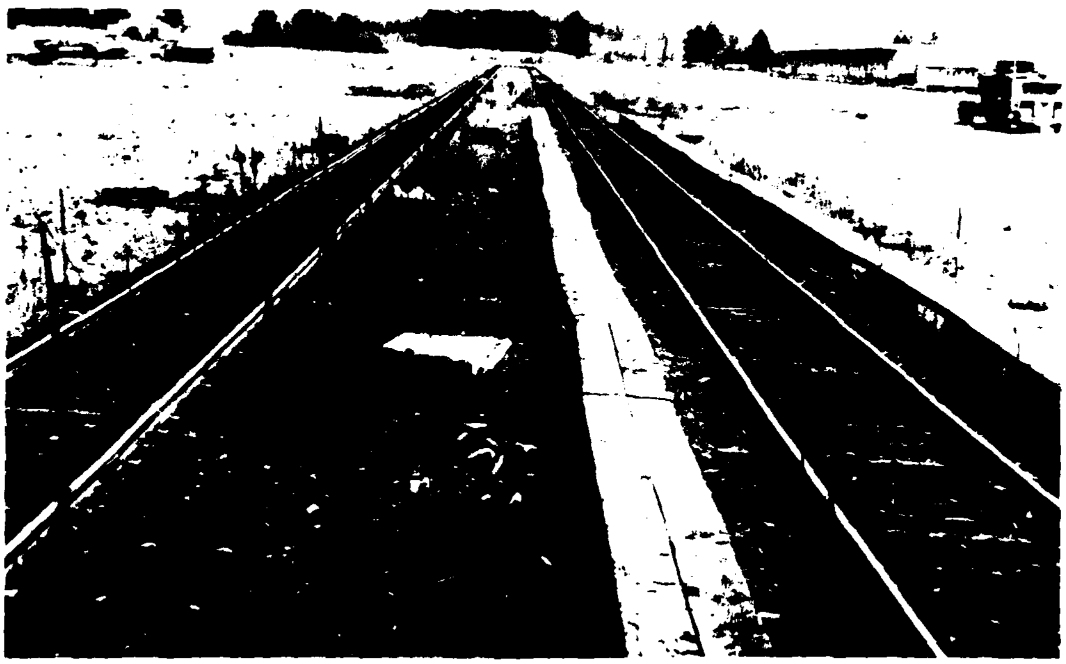


Figure 18. Tracks 10 (left) and 9 (right) (looking east).

Figure 19. Track 12 (looking west).

Figure 20. Concrete end ramp at tracks 5 (left) and 6 (right).

Figure 21. Tracks 1 (left), 2 (center), and 3 (right) with staging area.

Figure 22. Tracks 10, 5, 13, 14, 15, and 16 (left to right) (looking northeast).

Figure 23. Fort Lewis Logistics Center interchange yard (tracks 10, 5, 13, 14, 15, and 16 left to right) (looking northeast).

C. CURRENT PROCEDURES

The Burlington Northern Railroad serves Fort Lewis at three locations (namely: Main Post, Logistics Center, and North Fort Lewis), and the Union Pacific Railroad serves the installation at Main Post and North Fort Lewis. An agreement between BN and UP allows UP to use the BN tracks that serve Fort Lewis, with the provision that BN locomotive power is used to move the UP cars from the BN track 3 (UP storage track) to the installation. At Fort Lewis Main Post, the BN locomotive discharges incoming railcars on the installation's main line track 1 and picks up outgoing cars on the installation main line track 2. At the Logistics Center, the installation interchange yard is used, while at North Fort Lewis the "Y" and the rail siding adjacent to the solvent refined coal pilot plant are used for the pickup and delivery of railcars from the commercial railroad. The three Government-owned locomotives (two 80-ton and one 100-ton) perform switching functions within the installation. Rail operations averaged about 210 railcars per month from July through November 1977. Currently, no rail outloading plans have been developed by Fort Lewis personnel.

D. RAIL SYSTEM ANALYSIS

1. Current Outloading Capability

Current rail outloading capability at Fort Lewis is limited not by the physical attributes of the rail systems but by the shortage of small handtools, bridgeplates, and blocking and bracing materials. Currently, using only selected rail outloading sites by Fort Lewis Main Post and at the Logistics Center, approximately 300 railcars per day could be outloaded. This outloading rate would meet the requirement to outload the division and its support units within 10 days. However, the current supply of blocking and bracing materials is sufficient for only about 15 percent of the requirement (450 railcars). Also needed for a maximum efficient outloading operation are adequately trained blocking and bracing crews, as well as completed outloading plans.

2. Rail Outloading Analysis

A complex system structure can be viewed as a series of interconnected subsystems. The limiting subsystem within the system establishes the maximum outloading capability. Therefore, in ascertaining the maximum rail outloading capability of Fort Lewis, the following subsystem separation was used:

a. Commercial Service Capabilities

Commercial service capabilities present no problem to Fort Lewis. The common carriers serving the post are BN and UP, and their operations in the vicinity of Fort Lewis are well organized. Also, since Tacoma, Washington, is a major rail center and is only about 10 miles from Fort Lewis, rail support for the outloading operation should not be a major problem.

b. Moving to and Loading on Railcars at a Particular Site

The movement of cargo to loading sites is relatively quick and efficient since most of the equipment is self-propelled and access is along good paved roads. Traffic patterns and traffic control would have to be set up, but such measures should be standard for full-scale outloading operations. Staging areas near the outloading sites are adequate, but queuing will block some streets. Recent field tests, during loading operations, revealed that vehicles move along the

flatcars at an average speed of 1 mile per hour, with only one vehicle moving on a railcar at any one time. The longest string of empty flatcars used by the recommended outloading plan, assuming 57-foot car lengths (coupler to coupler), was 40 cars, the length of tracks 9, 10, 11, and 12 (Logistics Center). Using that figure, the first vehicle would reach the end of the last car 26 minutes after driving up the ramp; then blocking and bracing could begin. Loading time is insignificant in comparison with blocking and bracing time (table 3). Therefore, moving to and loading on the railcars is not the limiting subsystem. However, driving wheeled vehicles on flatcars "circus style"[3/] depends on the use of bridgeplates to span the gap between the cars. According to the plan employed in our analysis, bridgeplates are required for simultaneous loading at all sites where wheeled vehicles are to be loaded.

c. Blocking, Bracing, and Safety Inspections

Blocking, bracing, and safety inspection times are difficult to project. They depend on a number of variables such as:

(1) Crew size and experience

(2) Extent of the safety inspection

(3) Documentation

(4) Availability of blocking and bracing material and materials-handling equipment (MHE)

During REFORGER 76, the establishment of a 5-1/2- to 7-hour time limit for loading, blocking, and bracing at a loading site, as a reasonable goal for crews, was based on experience and actual field tests of circus-style loadings. In addition, discussions with the blocking and bracing instructors at Fort Eustis, Virginia, indicated that, to avoid wasted manhours, there should be no more than eight men per crew, regardless of experience.

[3/] Circus-style loading: Equipment is end loaded under its own power with little or no effort to fully utilize all floor space on the railcar, as time is critical.

TABLF 3

TIMES REQUIRED TO PERFORM VARIOUS LOADING FUNCTIONS

	Action	Type Vehicle or Item Being Loaded	How Loaded	Time Required Min-Sec	Considerations
Bilevels	**Vehicles Driving on Bilevel Railcars (89-ft long)**	Jeep	Own power	1'-00" per Railcar Length	Average of 5 timings
	Vehicles Driving on Bilevel Railcars (89-ft long)	1-1/4-Ton Pickup	Own power	1'-03" per Railcar Length	Average of 6 timings
	Vehicles Driving on Bilevel Railcars (89-ft long)	Gama Goat	Own power	1'-32" per Railcar Length	Average of 8 timings
	Average Total Time to Load, Tiedown Vehicles on Bilevel Railcar, Complete	The three types above plus 3/4-ton trucks, mixed	Own power	34'-00" per Railcar	Average number of Bilevels loaded in string of cars - 15
TOFC's	**Truck Tractor Backing Semitrailers on String of 89-ft TOFC Railcars**	Semitrailers	Truck tractor	0'-42" per Railcar Length	Average number of TOFC cars in string --11, 2 trailers per car
	Average Total Time to Load and Secure Semi-trailer to Hitch on TOFC Railcar	Semitrailers	Truck tractor	10'-00" per Semi-trailer	Average number of TOFC cars in string --11, 2 trailers per car
Flats	**2-1/2-Ton Trucks Circus Loading on 60-ft flats**	2-1/2-Ton Trucks	Own power	30"-45" per Railcar Length	Average of several timings
	Total Time to Circus Load 11 60-ft Flats With 2-1/2-Ton Trucks, 2 per car (load only)	2-1/2-Ton Trucks	Own power	35'-00" per 11 60-ft Cars	
Forklift	**Average Time for Rough Terrain Forklift Truck to Pick Standard-Size Containers (6-ft Wide, 8-ft Long, 5-ft High Approx) off Flatbed Truck, Transit 75 ft, and Load on Rail Flatcar.**	Containers	Forklift	2'-12" per Container	Average of loading of 18 containers

At Fort Lewis, blocking and bracing materials and small handtools are in short supply. These items, which are available locally, should be stockpiled to assure that the division and its support equipment can be outloaded within the time specified by the contingency plan. Blocking and bracing crews should be trained on a periodic basis.

d. Interchange of Empty and Loaded Railcars

An efficient interchange of empty and loaded railcars requires careful planning and good coordination with the common carrier. Such an interchange can be established at all three rail areas within Fort Lewis because the BN has good rail access and adequate trackage exists for interchange and storage of railcars.

The existence of several commercial railyards in Tacoma makes it possible to accumulate the number of empty cars required to maintain the operation. The various plans for spotting railcars depend on the type of operation. A place or location must be provided for railcars (1) in empty storage, (2) in loaded storage, and (3) at the loading sites. In general, three balanced or equally divided areas must exist somewhere in the vicinity.

Empty railcars destined for Fort Lewis should be accumulated and classified in Tacoma prior to being moved to Fort Lewis. Thus, if the interchange of railcars follows some semblance of the organization presented in the simulation (app B), this subsystem will not limit the rail outloading capabilities of Fort Lewis.

e. Summary

Considering all the subsystems, the shortage of blocking and bracing materials, bridgeplates, and small handtools, along with the lack of trained blocking and bracing crews, emerges as the primary factor restraining any large rail outloading operation at Fort Lewis. Therefore, provision of these items is the major prerequisite for a successful operation.

3. Rail System Outloading Options

The various options for outloading plans are shown in figure 24. Five plans for daylight-only loading were developed using various combinations of recommended rail loading sites at both Fort Lewis Main Post and the Logistics Center. The three balanced-areas approach, which includes loading sites, loaded storage, and empty storage, was utilized at Fort Lewis Main Post. However, at the Logistics Center only two balanced areas were developed, loading sites and empty storage. The loading sites at the Logistics Center have the dual function of providing the loaded storage also. This is possible because of the high railcar capacity of the loading sites and the short distance between the interchange yard (empty storage) and the loading sites.

As soon as the loading, blocking and bracing, and inspection of the cars are completed, the Government switching engines can begin placing the loaded cars in loaded storage for pickup by the BN railroad engines. Therefore, through proper planning, the main line locomotives can bring empties for the next cycle and pick up loaded cars from the loaded storage tracks. The exact procedure for all switching operations, arrival of main line locomotives, and departures is described in detail in the simulation for Plan 5 in appendix B. Five plans were developed to provide the approximate daily outloading rates of 50, 100, 150, 200, and 300 railcars. All plans function similarly.

Plan 1 uses tracks L1, L2, and L3, located on Fort Lewis Main Post, to produce an output of 45 railcars per day. This plan can be handled on the western end of the rail system.

Plan 2 adds tracks L4 at Fort Lewis Main Post and L1 at the Logistics Center, for a total output of 99 railcars per day.

Plan 3, which produces an outloading rate of 154 railcars per day, requires the addition of tracks L5 (Fort Lewis Main Post) and L2 (Logistics Center).

Plan 4 adds track L3, located on the Logistics Center, to the loading site to achieve 194 railcars per day.

Plan 5, the recommended plan, is shown in detail in appendix B. This plan achieves an outloading capability of 291 railcars per day, which fulfills the requirement to outload the division and its support units within approximately 10 days.

Track Sections[a] and Facilities	57-ft Coupler to Coupler	Type[b] End Ramp	Plan 1 45 RCPD	Plan 2 99 RCPD	Plan 3 154 RCPD	Plan 4 194 RCPD	Plan 5 291 RCPD
Ft Lewis Main Base							
L1	9	CON	X	X	X	X	X
L2	12	CON	X	X	X	X	X
L3	24	CON	X	X	X	X	X
L4	14	CON		X	X	X	X
L5	15	CON			X	X	X
L6	20	NONE					X
Logistics Center							
L1	40	CON		X	X	X	X
L2	40	CON			X	X	X
L3	40	CON				X	X
L4	40	NONE					X
L5	25	CON					X
L6	12	NONE					X

LEGEND

X - Track used for that option.
RCPD - Railcars per 24-hour day

a/ No costs for track repairs were shown since all tracks indicated are currently in good condition and meet Federal Track Safety Standards, Class 2; however, maintenance is required periodically to insure continued effectiveness.

b/ CON = concrete; NONE = no ramp.

Figure 24. Fort Lewis rail system outloading options.

4. Physical Improvements and Additions

Items listed below are all minimum requirements to provide the recommended outloading/receiving rate of 291 railcars per day (Plan 5) using existing trackage.

a. Acquire a minimum stock of blocking and bracing material needed to supplement the post organic supply for handling all equipment when a rapid deployment of post units is required. (For further information, see app D, Cost Estimate.)

b. Acquire bridgeplates for volume outloading of wheeled vehicles.

c. Acquire sufficient small tools to permit operation of blocking and bracing crews at all outloading sites. This includes power saws, cable cutters, wrecking bars, cable-tensioning devices, hammers, and so forth.

5. Discussion of Time and Costs

a. Physical Improvements

No costs for track repairs were used in this section since all selected tracks are currently in good condition and meet federal track safety standards, Class 2; however, maintenance is required periodically.

b. Load Time Versus Equipment Type

(1) Mobilization Moves. Of the two basic types of outloading moves (mobilization and administrative), mobilization moves occur only during national emergencies when urgency is paramount. The most rapid method of loading and securing mobile equipment on railcars is circus style. For example, if unit integrity is to be maintained, 2-1/2-ton trucks that are to pull trailers drive onto the string of railcars towing their trailers, and the equipment is secured in this configuration. This procedure is fast, but it wastes railcar space. During actual field tests on standard-type railcars, the loading, securing, and inspection of 2-1/2-ton trucks, two per railcar, site times varied from 5 hours for flatcars with chain tiedowns to 6-1/2 hours for flatcars without chain tiedowns (fig 25 and table 4, items 4 and 5).

This was a fast, efficient operation. Other similar operations that could occur in a mobilization-type move for most Army units include loading various sizes of containers onto standard-type flatcars by using forklifts. This operation, including loading, securing, and so forth, was accomplished in 5-1/2 hours (item 9).

Figure 25. Circus-style loading of 2-1/2-ton trucks.

All things considered, the circus-style loading operations indicate that, for mobilization moves, using standard-type flatcars, the loading, blocking and bracing, and inspections can be accomplished within 5-1/2 to 7 hours for most equipment types (items 9 and 5). However, if a unit has a significant number of small items, such as "mules" (item 6), 10-hour site time will likely be required. This should be considered, rather than assume that the work can be accomplished within 7 hours.

(2) Administrative Moves. For an administrative move, plenty of time exists for planning; night operations are unnecessary except to finish work that is not completed during daylight hours and to switch railcars. This added flexibility helps to solve unforeseeable problems. The administrative move allows time to accumulate special-type railcars, such as bilevel autoracks and TOFC and COFC cars, which significantly reduce both labor and costs. For instance, small vehicles, jeeps,

TABLE 4
TYPICAL SITE LOADING AND BLOCKING AND

LEGEND
Type Railcar
B1 - Bilevel
TOFC - Trailer on flatcar
COFC - Container on Flatcar

DF - Flatcar/Integral Ch
F - Standard-Type Flatca

Item	Type Railcar	Average Number Loaded (Range)	Type Load	How Loaded	Total Site Time Required (hrs) and Other Considerations	Details on T
1	B1 89 ft	16 15-17	C	End, own power	7.5 All cars had chain tiedowns. Cars did not have bridge PL's, wooden PL's used	Typical Load: 50 jeeps, 6-1¼ ton, 14 Gama Goats, number vehicles - 170
2	B1 89 ft	14½ 11-18	C	End, own power	10.7 All cars did not have chain tiedowns, used wooden bridge PL's.	Typical Load: 50 jeeps, 6-1¼ ton, 14 Gama Goats, number vehicles - 170
3	TOFC 89 ft	12 10-12	C	End, backed on by tractor	4.0	Semitrailers - mostly MI to form 40-ft semis. So military vans on semis.
4	DF 60 ft	11 9-14	C	End, own power	5.1 Chain tiedowns on all cars, wood wheel chocks, lateral wood blocking at wheels	All 2-1/2-ton trucks, va per railcar.
5	F 54 ft	10	C	End, own power	6.5 Cable tiedowns made at site. Wheel chocks, lateral wheel blocking	All 2-1/2-ton trucks, va per railcar.
6	F 54 ft	10 9-10	A	End, own power. Some forklift	10.0 Cable tiedowns made at site. Wood blocking as required.	1/4-ton trailers Wreckers Forklifts Mules, jeeps, CONEX con
7	F 54 ft	9	A	Forklift, manpower	10.8 Cable tiedowns made at site. Wood blocking as required.	All 1/4-ton trailers or of similar small items.
8	DF 60 ft	10 8-13	A	Rough terrain forklifts	8.3 Chain tiedowns on all cars. Wheel blocking used also	All two-wheeled traile pulled by 2-1/2-ton tru 5 trailers/railcar
9	F 54 ft	9	A	Rough terrain forklifts	5.5 Cable tiedowns made at site. Blocking as required.	All containers - 5 cars with 8 containe 3 cars with 4 containe 1 car with 10 containe

TABLE 4
DING AND BLOCKING AND BRACING TIMES (TOTAL)

- Flatcar/Integral Chain Tiedowns
- Standard-Type Flatcar

Type Load
A - Administrative
C - Circus

Details on Type Load	Manpower	Typical Problems
ical Load: 50 jeeps, 15-3/4-ton trucks, ¼ ton, 14 Gama Goats, each level, total ber vehicles - 170	1½-2 men per vehicle	No bridge PL's on cars had to use wooden PL's. Man has to walk to front of vehicle as guide and to straighten bridge PL's. Delays if all vehicles not at site at loading time.
ical Load: 50 jeeps, 15-3/4-ton trucks, ¼ ton, 14 Gama Goats, each level, total ber vehicles - 170	1½-2 men per vehicle	Same as above; and, missing tiedowns; cable tiedowns had to be fabricated and used. (Storm, rain not included in total time)
itrailers - mostly MILVAN married together form 40-ft semis. Some 20-ft semis and itary vans on semis. Two per TOFC car.	6-8 man crew	Some older cars have trailer hitches which have to be "pulled-up" into position by a cable attached to the tractor.
2-1/2-ton trucks, various kinds, two railcar.	10 men per railcar	None
2-1/2-ton trucks, various kinds, two railcar.	10 men per railcar	None
-ton trailers ckers klifts es, jeeps, CONEX containers	10 men per railcar	Improper installation of tiedowns and blocking. Large number of small items, 1/4-ton trailer slow the installation of blocking since work has to proceed from one end of railcar to the other.
1/4-ton trailers or high percentage similar small items.	10 men per railcar	Improper installation of tiedowns and blocking. Large number of small items, 1/4-ton trailer slow the installation of blocking since work has to proceed from one end of railcar to the other.
two-wheeled trailers (various types led by 2-1/2-ton trucks) railers/railcar	10 men per railcar	None noted
containers - ars with 8 containers each. ars with 4 containers each. ar with 10 containers each.	10 men per railcar	None noted

2

3/4-ton trucks, 1-1/4-ton trucks, and gama goats can be loaded on bilevel cars (fig 26); semitrailers and vans can be loaded on TOFC cars; and MILVANs, for which there are no chassis, can be loaded on COFC cars. Mobile equipment, some 2-1/2-ton trucks, and all smaller vehicles can be loaded on bilevel railcars. These three specific types of railcars require no blocking and bracing except that integral to the car.

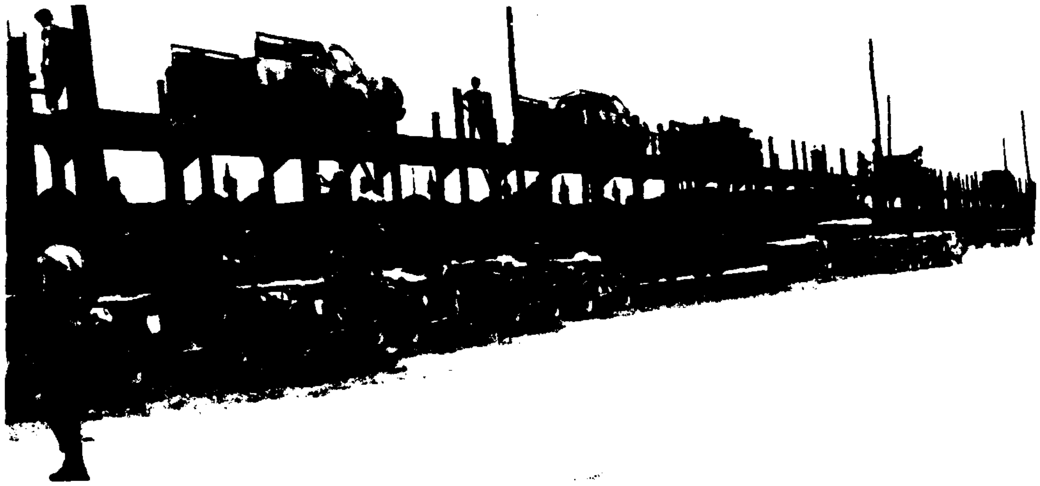


Figure 26. Lower level of bilevel cars loaded with jeeps, gama goats, 3/4-ton trucks, and 1-1/4-ton trucks.

Loading and securing times for bilevels varied from an average of 7-1/2 hours for a string of cars that were fully equipped with chain tiedowns, to 10-3/4 hours for those where cable tiedowns to replace missing chain tiedowns had to be fabricated. The average total time for TOFC cars was 4 hours. Administrative loading, which requires relatively more time and effort, is illustrated in figures 27 and 28.[4/] This type of loading required a total site time of 10 to 11 hours. In general,

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[4/] Administrative loading: Equipment to be loaded (wheeled or otherwise) is placed on the car so as to achieve maximum utilization of floor space; it may be stacked; cost is important. Both types of loading, circus style and administrative, may be used in either a mobilization or administrative move, depending upon the type of equipment to be moved. Example - item 9 in a mobilization move, item 5 in an administrative move.

administrative moves should be planned for daylight hours, leaving night hours available for finishing up sites that started late or were slowed by problems and railcar switching. This type of planning allows enough flexibility to resolve problems and complete the operation on schedule. For mobilization moves, site time to load and secure equipment on a string of railcars should be accomplished in 5-1/2 to 7 hours, and for administrative moves, 4 to 11 hours, items 3 and 7.

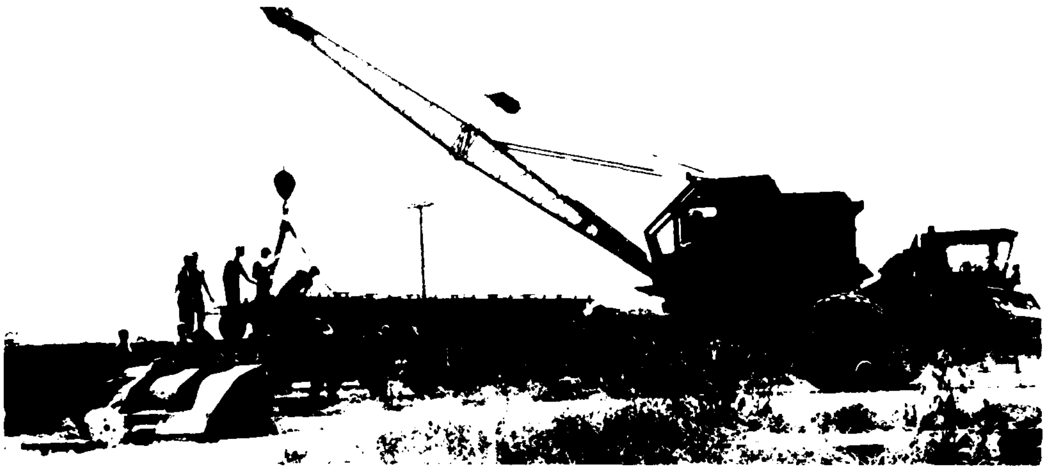

Figure 27. Administrative loading, mules.

Figure 28. Administrative loading, 1/4-ton trailers.

The time/motion studies conducted during the REFORGER 76 exercise (an administrative move) resulted in the accumulation of valuable information for planning future station outloading operations and is included in tables 3 and 4. It should be noted that times required to load are relatively minor as compared with times required to secure the equipment. As an example, a jeep can drive across an 89-foot-long bilevel car in 1 minute and a forklift truck can load a container in 2 minutes 12 seconds. So, loading times are not the problem. Also, as soon as the first vehicle is in position, several simultaneous operations are in effect--loading, blocking, and tieing down. Thus, for future planning, site times should be used; as a general rule, 5-1/2 to 7 hours for a mobilization move, and 4 to 11 hours for an administrative move. The 5-1/2-hour minimum for a mobilization move is based on the assumption that only standard-type railcars are available. The 4-hour minimum for an administrative move assumes that there is time to plan and assemble the most appropriate type of railcars for the equipment to be moved. The 4 hours, in this instance, was the average time required to load and secure semitrailers and vans on a string of twelve 89-foot-long TOFC cars.

To minimize the number of faulty or unacceptable loads that have to be done over, inspection of the loaded cars by the railroad inspector should proceed simultaneously with the work.

c. Transportation Equipment Costs--Bilevel Railcars Versus 54-Foot Standard Flatcars

A cost comparison, using nine different types of equipment scheduled for outloading in the REFORGER 77 exercise, revealed that $129,431 in transportation and materials (timber, cable, and so forth) could be saved by shipping the equipment on bilevel railcars rather than on standard-type 54-foot flatcars. The equipment items vary from 1/4-ton trailers to 2-1/2-ton trucks. A total of 623 vehicles could be transported on 55 bilevel railcars; see table 5 for details and appendix C for more information on special-purpose railcars.

TABLE 5

COST COMPARISON, BILEVEL VERSU

Column Number	1	2	3	4	5	6	7
Item No.	Vehicle Type	Model Number	Weight (lbs)	Height (in.)	Length (in.)	Quantity to be Shipped	Quanti on 54- Railc
1	2-1/2-Ton Truck	M35A2	13,360	80.8	264.8	110	2
2	Gama Goat, 1-1/4-Ton	M561	7,480	71.9	231.1	27 1/	2
3	M105A2 1-1/2-Ton Trailer	M105A2	2,670	82.0	166.0	113	3
4	1/4-Ton Trailer	M416	580	44.0	108.5	136	10
5	400-Gal Water Trailer	M149A1	2,530	80.6	161.4	20	4
6	1-1/4-Ton Truck	M880	4,695	73.5	218.5	11	2
7	3/4-Ton Trailer	M101	1,350	50.0	147.0	8	4
8	1/4-Ton Truck	M151	2,350	52.5	131.5	180	7
9	1-1/4-Ton Como Truck	M884	4,648	67.5	218.5	18	2
	Total					623	

SUMMARY

Total cost to ship the 9 different items (623 vehicles) by 54-foot-long standard flatcars, Colu
Total cost to ship the 9 different items (623 vehicles) by 89-foot-long bilevel flatcars, Column
Savings in transportation costs if shipped by bilevel flats (Column 10-- Column 14)
Additional costs of blocking and bracing materials if shipped by 54-foot standard flatcars
Total savings if these nine items shipped by bilevel versus 54-foot flatcar

1/ Excess vehicles shipped on other railcars that are not completely utilized.
2/ Estimated average additional costs of blocking and bracing materials per vehicle.

TABLE 5
ISON, BILEVEL VERSUS 54-FOOT FLATCARS

6 Quantity to be Shipped	7 Quantity on 54-ft Railcar	8 Dollars	9 No. of 54-ft Cars Required	10 (8 x 9) Trans Cost for Item	11 Quantity on 89-ft Bilevel	12 Dollars	13 No. of Bilevels Required	14 (12 x 13) Trans Cost for Item
110	2	2,413	55	132,715	6	7,238	18	130,284
27 1/	2	2,167	13	28,171	8	5,402	4	21,608
113	3	2,167	37	80,179	12	3,612	9	32,508
136	10	2,167	14	30,338	36	3,612	4	25,284
20	4	2,167	5	10,835	12	3,612	2	7,224
11	2	2,167	5	10,835	8	3,612	2	7,224
8	4	2,167	2	4,334	12	3,612	1	3,612
180	7	2,167	25	54,175	14	3,612	13	46,956
18	2	2,167	9	19,503	8	3,612	2	4,334
623				371,085			55	279,034

rd flatcars, Column 10	$371,085	
el flatcars, Column 14	279,034	
mn 14)	$ 92,051	
dard flatcars	37,380	($60 2/ x 623)
	$129,431	

cle.

2

III. ANALYSIS OF COMMERCIAL RAIL FACILITIES WITHIN THE TACOMA AREA

Currently, the rail facilities at Fort Lewis are more than adequate to handle the continuing rail outloading requirement of the installation. However, the Burlington Northern (BN) and the Union Pacific (UP) commercial rail facilities within Tacoma were surveyed to determine the feasibility of using them during full-scale rail outloading operations at the installation, table 6. Many factors were considered in making the determinations, including:

TABLE 6
RAILROAD FACILITIES WITHIN THE TACOMA AREA

Location and Figure Number	End Ramp	Lighting	Surface Conditions	Staging Area	Railcar Capacity	Access Availability	Present Track Conditions
Burlington Northern Yard, Fig 29	Double timber	No	Good	Yes	12	Good	Fair
Union Pacific Yard, Fig 30	Yes	Some	Good	Yes	5	Good	Good
Union Pacific Yard, Fig 31	Double concrete	Yes	Good	Yes	10	Good	Good
Union Pacific Yard	Metal portable	Some	Good	Yes	5	Good	Good

a. Road access to the facility

b. Type of facility available--ramps, lighting

c. Equipment staging and queuing areas

d. Railcar storage and loading capacities

e. Track and facility maintenance conditions

f. Main line activity levels

g. Added expense of using commercial facilities

h. Security problems

The BN has one double wooden end ramp, figure 29, and UP has one single and one double concrete end ramp, figures 30 and 31. Also, one portable end ramp is available to use at the UP rail facilities. Both of the sites have scattered lighting and only small staging areas. Portable ramps possibly could be used at some of the other sites for daytime operations; however, this is not recommended for any of the sites because most trackage

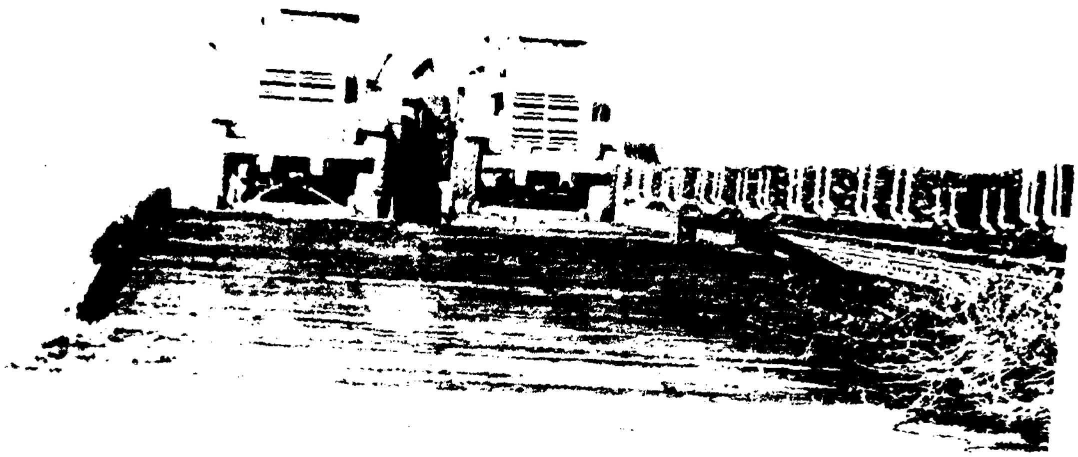

Figure 29. Timber end ramp, BN yard, Tacoma.

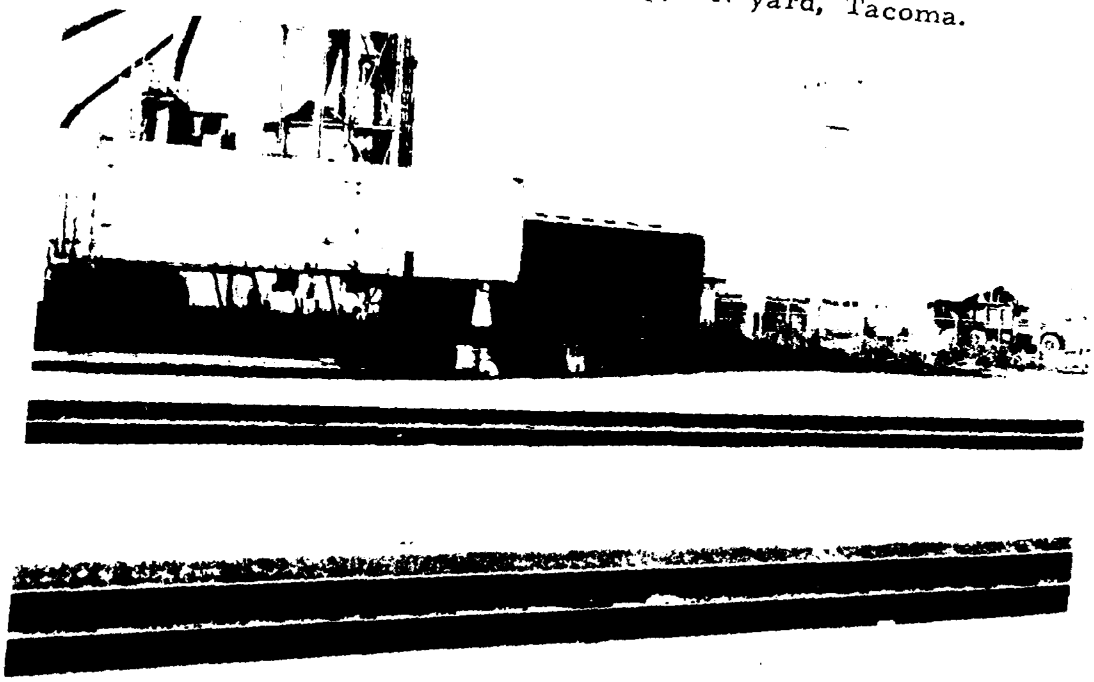

Figure 30. Concrete end ramp, UP yard, Tacoma.

Figure 31. Double concrete end ramp, UP yard, Tacoma.

will be needed for storage to support local service and full-scale activity at Fort Lewis. Two important reasons for restricting the use of off-post facilities to store empty railcars are security and the splitting of operations, which could cause complications.

IV. SPECIAL EQUIPMENT FOR EXPEDITING THE OUTLOADING OF MILVANS

A large supply of trailer-on-flatcar railcars is usually in the system, and container-on-flatcar railcars may be available. These cars should be used to transport semitrailers and MILVANs. If COFC or TOFC flatcars are not available, some blocking and bracing time and expense can be saved by using bulkhead flatcars for transporting MILVANs. See appendix C for additional information.

V. ANALYSIS OF MOTOR SYSTEM OUTLOADING CAPABILITY

A. GENERAL

Currently, major highway access to Fort Lewis is provided by Interstate Route 5, which bisects the installation. A cloverleaf interchange provides access from I 5 to Fort Lewis Main Post and to North Fort Lewis, and a diamond interchange provides access to the Logistics Center. The internal road network within Fort Lewis is capable of handling all types of highway vehicles along its major arteries. Neither access to the highway system nor the system itself restrains motor outloading capability or movement of roadable military vehicles.

B. MOTOR LOADING FACILITIES

Basically, two types of motor vehicles, flatbed and van semitrailers, would be required to meet the motor outloading needs of Fort Lewis. A description of the loading facilities associated with each vehicle type follows:

1. Loading Ramps

A survey of facilities that might have end-loading ramps for loading vehicles onto commercial flatbed semitrailers revealed that there are 8 such ramps with 17 outloading positions that could be used concurrently with a rail outloading operation (table 7 and figs 32 through 38). Of the 17 positions, Fort Lewis Main Post has 2; Logistics Center, 11; and North Fort Lewis, 4. As a separate operation, without rail outloading, there are 21 ramps with 35 outloading positions, which include all existing rail ramps and a portable bilevel/trilevel ramp. Fort Lewis Main Post has 12 loading positions for commercial flatbed semitrailers, Logistics Center has 17, and North Fort Lewis has 5.

2. Loading Platforms and Docks

The other type of motor outloading facility is the loading platform from which van semitrailers are loaded. The platform and the forklift are used to transfer cargo from truck to truck, truck to warehouse, and vice versa. The Logistics Center appears best suited for van semitrailer loading at Fort Lewis since it has a large number of warehouses with loading docks. Using only selected warehouses at the Logistics Center, such as 9630, 9660, 9665, and 9670, over 55 van-outloading positions could be utilized. Figure 39 shows the loading dock associated with warehouse 9665.

TABLE 7
VEHICLE END-LOADING RAMPS

Ramp or Other Device and Figure Number	Location[1/]	Type of Ramp	Surface Condition	Staging	Access	Remarks
		Concurrent With Rail Operations				
1 Fig 32	Between tracks 3 & 4 (FLMB)	Timber and earth with gravel surface	Good	Yes	Good	
1	Any gravel area (FLMB)	Timber	Depends on site selected	Depends on site selected	Depends on site selected	
1 Fig 33	North of track 12 (LC)	Timber and earth with gravel surface	Good	Yes	Good	
8 Fig 34	South L St and Rainier Ave (LC)	Concrete and gravel	Good	Yes	Good	
2 Fig 35	Tracks 2 & 3 (LC)	Concrete	Good	Yes	Good	
2 Fig 36	Tracks D & E (NFL)	Concrete	Good	Yes	Good	
2 Fig 37	Track A (NFL)	Concrete	Good	Yes	Good	
Numerous (cut sloping ditch with bulldozer)	Any graveled area	Sloping earth ditch	Depends on site selected	Depends on site selected	Depends on site selected	These ramps will not be included in the estimate of outloading capability
3 Forklifts commercial, 15,000-pound capacity	Mobile	NA	Depends on site selected	Depends on site selected	Depends on site selected	It is assumed that these forklifts are being used for loading railcars.
		Without Rail Operations				
17 above				See above		
3 above (forklifts)				See above		
1 Fig 38	Portable	Adjustable bilevel/tri-level	Depends on site selected	Depends on site selected	Depends on site selected	
6	Tracks 3, 4 5, 6, 6A, & 6B (FLMB)	5 concrete and 1 timber end ramps	Good	Yes	Good	
4	Tracks 4 & 6 (FLMB)	2 concrete side ramps	Good	Yes	Good	
6	Tracks 5, 6, 9, 10, 11, & 12 (LC)	Concrete	Good	Yes	Good	
1	Track F (NFL)	Concrete	Good	Yes	Good	

[1/] Legend

FLMB - Fort Lewis Main Post; LC - Logistics Center; NFL - North Fort Lewis

Figure 32. Timber and earth ramp between tracks 3 and 4 (Main Post).

Figure 33. Timber and earth ramp north of track 12 (Logistics Center).

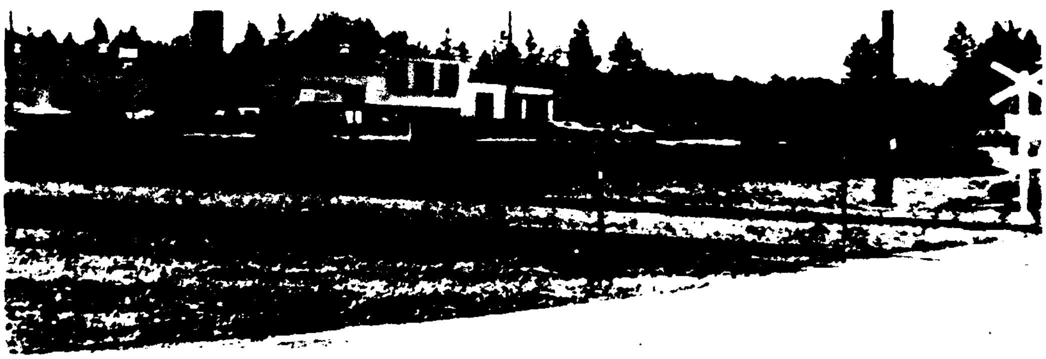

Figure 34. Concrete ramp near South L Street and Rainier Avenue (Logistics Center).

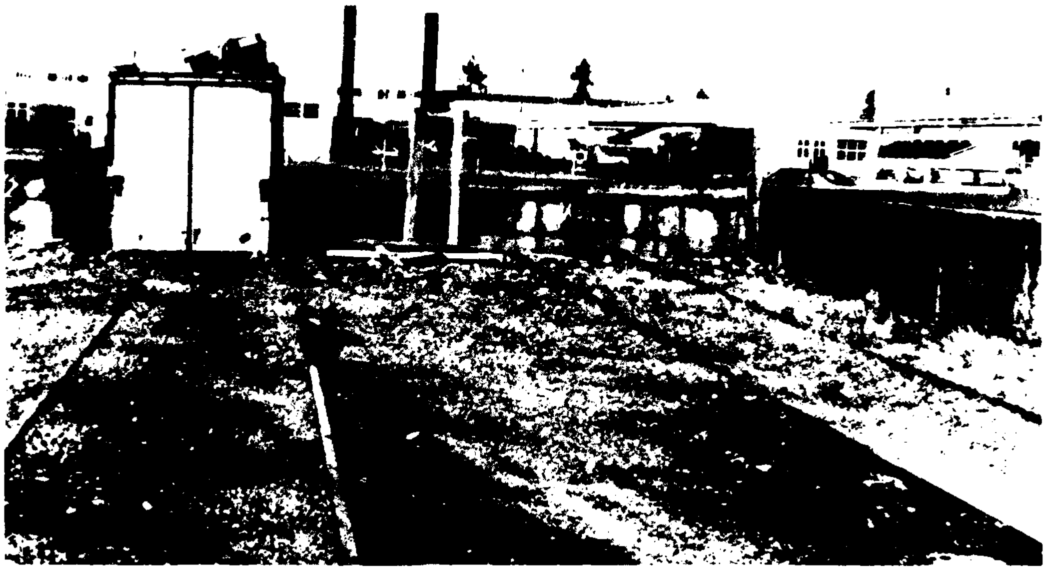

Figure 35. Concrete end ramp at tracks 2 and 3 (Logistics Center).

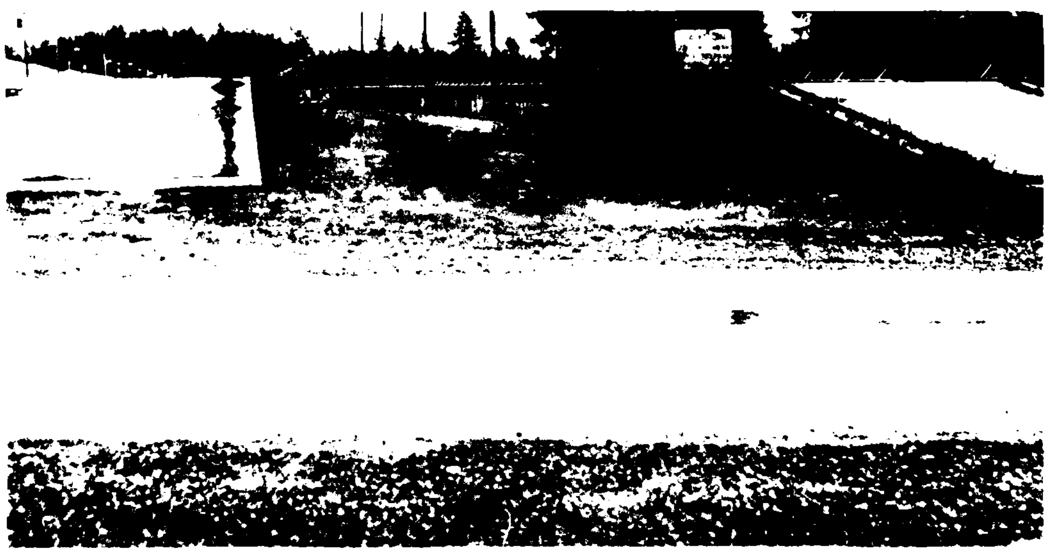

Figure 36. Concrete end ramps at track D and E (North Fort Lewis).

Figure 37. Concrete side ramp at track A (North Fort Lewis).

Figure 38. Bilevel/trilevel ramp.

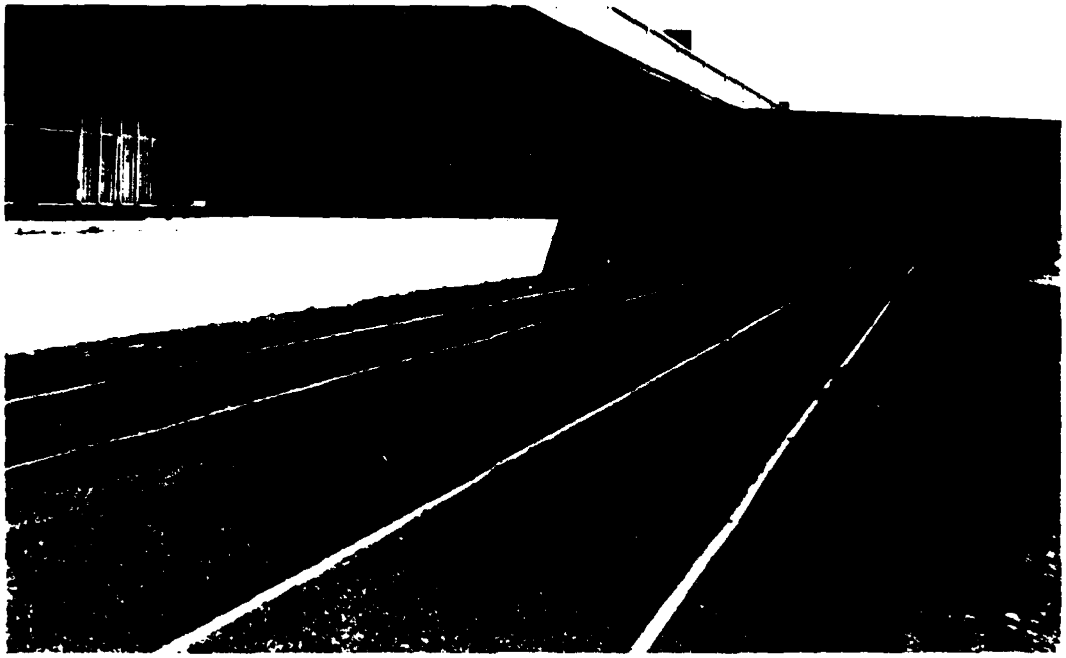

Figure 39. Loading dock adjacent to warehouse 9665, Logistics Center.

C. FLATBED SEMITRAILER OUTLOADING

The loading procedure could be as follows: A vehicle is driven up the ramp and onto the waiting semitrailer, temporary chocks are placed, and the loaded truck is driven slowly away from the ramp to a designated location where the loaded vehicle is secured with tiedown chains. The next semitrailer is backed up to the ramp, and the procedure is repeated. Under this procedure the ramp is not occupied while loaded vehicles are being secured. Using a conservative 60 minutes for each cycle, one semitrailer could be loaded per hour per ramp, or 10 vehicles per ramp per 10-hour shift. In most cases, 60 minutes would not be required.

1. Concurrent With Rail Operations

There are 8 ramps with 17 outloading positions that could be used while rail operations are in progress. Using a 60-minute cycle per ramp, a 10-hour workday could produce 170 semitrailer loads, for daylight operation only. This does not include expedient means such as excavating sloping ditches into which semitrailers could be backed for loading, nor the 15,000-pound commercial forklift

trucks that could be used if not assigned to railcar loading, nor the mobile cranes that also could be used. Numerous possibilities exist for increasing motor outloading facilities.

2. Without Rail Operations

If rail operations are not in progress, there are 21 loading ramps with 35 outloading positions to load commercial semitrailers. At 60 minutes per cycle per ramp, 350 semitrailers could be outloaded in a 10-hour workday. However, the possibility of obtaining 350 commercial semitrailers locally on any day seems highly unlikely; even 170 seems unlikely. Therefore, since Fort Lewis has facilities for outloading a large volume of semitrailers, any constraint on its semitrailer outloading capability is not the lack of facilities, but the lack of semitrailers.

Since Fort Lewis' designated POE is on the east coast, and since its rail system is potentially capable of supporting major rail outloading operations, all equipment should be shipped by rail. Therefore, semitrailer outloading is not a significant consideration.

D. VAN SEMITRAILER OUTLOADING

The loading procedure could be as follows: A van is backed up to the loading platform and cargo is transferred to the van from either an adjacent van or warehouse, using one forklift per van being loaded. A cycle time of approximately 2-1/2 hours will be used to load a 40-foot van. At this rate, one van could be loaded each 2-1/2 hours per position, or four vehicles per position each 10-hour shift. The railroad tracks adjacent to the indicated warehouses are not required in a unit move for rail; therefore, all 55 loading positions at the warehouses are available. However, at least 55 forklifts of the 2,000- and 4,000-pound size are required. At present, Fort Lewis has 67 forklifts of the 2,000- and 4,000-pound size. At 2-1/2 hours per cycle per position, 220 vans could be outloaded in a 10-hour workday at the Fort Lewis Logistics Center.

VI. CONCLUSIONS

1. Because Fort Lewis' designated POE is on the east coast, unit equipment should be outloaded by rail.

2. The Fort Lewis railroad tracks are in basically good conditions. The primary constraint limiting its rail outloading capability is the shortage of blocking and bracing materials, small handtools, bridgeplates, and trained blocking and bracing crews.

3. After the deficiencies noted above are corrected and on receipt of a sufficient number of railcars to permit full-scale outloading, Fort Lewis could achieve an outloading/receiving rate of 291 railcars per 24-hour period. At this rate, the division and its support units' equipment could be outloaded in 10 days. (The nonroadable equipment could be outloaded in 1 day.)

4. No costs for track repairs were indicated, since all selected tracks are currently in good condition and meet federal track safety standards, Class 2; however, maintenance is required periodically to insure continued effectiveness. Costs for needed handtools, bridgeplates, and blocking and bracing material would be additional.

5. Empty railcars (dedicated train lengths) destined for Fort Lewis should be positioned, in train-loading sequence, in Tacoma.

6. The BN and UP representatives did not express any reservations regarding the outloading of Fort Lewis units concurrently with commercial demands. However, Fort Lewis' transportation personnel should coordinate planning of impending outloading operations with the BN and UP representatives at the earliest possible date.

7. The three Government-owned switching engines (two 80-ton and one 100-ton) would be required for shifting empty and loaded cars to produce an output of 291 railcars per 24-hour day. These engines are in addition to the locomotive power required to pick up six loaded trains per day.

8. For administrative-type moves, when leadtime is plentiful and costs must be considered, special-purpose railcars (such as bilevel autoracks, trailer-on-flatcar (TOFC), and container-on-flatcar (COFC) cars) are more cost-effective than the standard types and should be used to the extent they are available.

9. For mobilization moves, when time is more critical than cost, the use of special-purpose railcars may not be possible because of the short leadtime and relatively short supply of these high-demand cars.

10. Most of the Fort Lewis rail operations personnel are approaching retirement; therefore, if trainees are not hired, the capability of Fort Lewis to support rail outloadings will be lost in a few years.

11. For concurrent rail and motor operations, 170 flatbed and 220 van semitrailers could be loaded per 10-hour day (for daylight operations only), and for separate operations, 220 van and 350 flatbed semitrailers could be loaded during the same period. This capability far exceeds the probable available supply of semitrailers.

12. The maximum degree of curvature of the railroad tracks is 8 degrees at North Fort Lewis, 8 degrees 6 minutes at Main Post, and 6 degrees at the Logistics Center. Consequently, any known length of railcar can be used on the installation.

VII. RECOMMENDATIONS

1. Undertake those items listed in section II, paragraph D4, "Physical Improvements and Additions." These improvements will provide a rail system capability of 291 railcars per 24-hour day as well as an effective rail system.

2. Prepare a detailed unit outloading plan, using the simulation in appendix B as an example, that specifies unit assignments at loadout sites and movement functions.

3. Coordinate rail outloading plans with the BN and UP railroad representatives at the earliest possible date.

4. Continue rail facility maintenance to perpetuate an effective rail system.

5. Provide advance training for blocking and bracing crews.

6. Retain the three Government-owned switching engines to support major outloading operations.

7. Station road guards at all railroad crossings during outloading operations, and provide all train crewmen with walkie-talkies to insure a safer, more efficient operation.

8. Hire trainees to replace locomotive crew members who are nearing retirement.

9. Keep abreast of the BN and UP Railroads maintenance plans.

10. Use special-purpose railcars (such as bilevel autoracks for small vehicles, TOFC cars for semitrailers and vans, and COFC cars for MILVANs) for administrative-type moves and, as available, for mobilization moves.

11. Provide warehousing for the blocking, bracing, and small tool supplies.

12. Coordinate with MTMC any planned railroad track removal that is included in the proposed mobilization outloading plan.

13. For new track construction the maximum degree of curvature should be limited to 12 degrees.

APPENDIX A
TRACK SAFETY STANDARDS [5/]

PART 213—TRACK SAFETY STANDARDS

Subpart A—General

Sec.
213.1 Scope of part.
213.3 Application.
213.5 Responsibility of track owners.
213.7 Designation of qualified persons to supervise certain renewals and inspect track.
213.9 Classes of track: operating speed limits.
213.11 Restoration or renewal of track under traffic conditions.
213.13 Measuring track not under load.
213.15 Civil penalty.
213.17 Exemptions.

Subpart B—Roadbed

213.31 Scope.
213.33 Drainage.
213.37 Vegetation.

Subpart C—Track Geometry

213.51 Scope.
213.53 Gage.

Sec.
213.55 Alinement.
213.57 Curves; elevation and speed limitations.
213.59 Elevation of curved track; runoff.
213.61 Curve data for Classes 4 through 6 track.
213.63 Track surface.

Subpart D—Track Structure

213.101 Scope.
213.103 Ballast; general.
213.105 Ballast; disturbed track.
213.109 Crossties.
213.113 Defective rails.
213.115 Rail end mismatch.
213.117 Rail end batter.
213.119 Continuous welded rail.
213.121 Rail joints.
213.123 Tie plates.
213.125 Rail anchoring.
213.127 Track spikes.
213.129 Track shims.
213.131 Planks used in shimming.
213.133 Turnouts and track crossings generally.
213.135 Switches.
213.137 Frogs.
213.139 Spring rail frogs.
213.141 Self-guarded frogs.
213.143 Frog guard rails and guard faces; gage.

Subpart E—Track Appliances and Track-Related Devices

213.201 Scope.
213.205 Derails.
213.207 Switch heaters.

Subpart F—Inspection

213.231 Scope.
213.233 Track inspections.
213.235 Switch and track crossings inspections.
213.237 Inspection of rail.
213.239 Special inspections.
213.241 Inspection records.

APPENDIX A—MAXIMUM ALLOWABLE OPERATING SPEEDS FOR CURVED TRACK

AUTHORITY: The provisions of this Part 213 issued under sections 202 and 209, 84 Stat. 971, 975; 45 U.S.C. 431 and 438 and § 1.49(n) of the Regulations of the Office of the Secretary of Transportation; 49 CFR 1.49(n).

SOURCE: The provisions of this Part 213 appear at 36 F.R. 20336, Oct. 20, 1971, unless otherwise noted.

Subpart A—General

§ 213.1 Scope of part.

This part prescribes initial minimum safety requirements for railroad track

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[5/] Extracted from Title 49, Transportation, Parts 200 to 999, pp 8-19, Code of Federal Regulations, 1973.

that is part of the general railroad system of transportation. The requirements prescribed in this part apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track.

§ 213.3 Application.

(a) Except as provided in paragraphs (b) and (c) of this section, this part applies to all standard gage track in the general railroad system of transportation.

(b) This part does not apply to track—

(1) Located inside an installation which is not part of the general railroad system of transportation; or

(2) Used exclusively for rapid transit, commuter, or other short-haul passenger service in a metropolitan or suburban area.

(c) Until October 16, 1972, Subparts A, B, D (except § 213.109), E, and F of this part do not apply to track constructed or under construction before October 15, 1971. Until October 16, 1973, Subpart C and § 213.109 of Subpart D do not apply to track constructed or under construction before October 15, 1971.

§ 213.5 Responsibility of track owners.

(a) Any owner of track to which this part applies who knows or has notice that the track does not comply with the requirements of this part, shall—

(1) Bring the track into compliance; or

(2) Halt operations over that track.

(b) If an owner of track to which this part applies assigns responsibility for the track to another person (by lease or otherwise), any party to that assignment may petition the Federal Railroad Administrator to recognize the person to whom that responsibility is assigned for purposes of compliance with this part. Each petition must be in writing and include the following—

(1) The name and address of the track owner;

(2) The name and address of the person to whom responsibility is assigned (assignee);

(3) A statement of the exact relationship between the track owner and the assignee;

(4) A precise identification of the track;

(5) A statement as to the competence and ability of the assignee to carry out the duties of the track owner under this part; and

(6) A statement signed by the assignee acknowledging the assignment to him of responsibility for purposes of compliance with this part.

(c) If the Administrator is satisfied that the assignee is competent and able to carry out the duties and responsibilities of the track owner under this part, he may grant the petition subject to any conditions he deems necessary. If the Administrator grants a petition under this section, he shall so notify the owner and the assignee. After the Administrator grants a petition, he may hold the track owner or the assignee or both responsible for compliance with this part and subject to penalties under § 213.15.

§ 213.7 Designation of qualified persons to supervise certain renewals and inspect track.

(a) Each track owner to which this part applies shall designate qualified persons to supervise restorations and renewals of track under traffic conditions. Each person designated must have—

(1) At least—

(i) One year of supervisory experience in railroad track maintenance; or

(ii) A combination of supervisory experience in track maintenance and training from a course in track maintenance or from a college level educational program related to track maintenance;

(2) Demonstrated to the owner that he—

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in this part.

(b) Each track owner to which this part applies shall designate qualified persons to inspect track for defects. Each person designated must have—

(1) At least—

(i) One year of experience in railroad track inspection; or

(ii) A combination of experience in track inspection and training from a course in track inspection or from a college level educational program related to track inspection;

(2) Demonstrated to the owner that he—

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this part, pending review by a qualified person designated under paragraph (a) of this section.

(c) With respect to designations under paragraphs (a) and (b) of this section, each track owner must maintain written records of—

(1) Each designation in effect;

(2) The basis for each designation, and

(3) Track inspections made by each designated qualified person as required by § 213.241.

These records must be kept available for inspection or copying by the Federal Railroad Administrator during regular business hours.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973]

§ 213.9 Classes of track: operating speed limits.

(a) Except as provided in paragraphs (b) and (c) of this section and §§ 213.57 (b), 213.59(a), 213.105, 213.113 (a) and (b), and 213.137 (b) and (c), the following maximum allowable operating speeds apply:

[In miles per hour]

Over track that meets all of the requirements prescribed in this part for—	The maximum allowable operating speed for freight trains is—	The maximum allowable operating speed for passenger trains is—
Class 1 track	10	15
Class 2 track	25	30
Class 3 track	40	60
Class 4 track	60	80
Class 5 track	80	90
Class 6 track	110	110

(b) If a segment of track does not meet all of the requirements for its intended class, it is reclassified to the next lowest class of track for which it does meet all of the requirements of this part. However, if it does not at least meet the requirements for class 1 track, no operations may be conducted over that segment except as provided in § 213.11.

(c) Maximum operating speed may not exceed 110 m.p.h. without prior approval of the Federal Railroad Administrator. Petitions for approval must be filed in the manner and contain the information required by § 211.11 of this chapter. Each petition must provide sufficient information concerning the performance characteristics of the track, signaling, grade crossing protection, trespasser control where appropriate, and equipment involved and also concerning maintenance and inspection practices and procedures to be followed, to establish that the proposed speed can be sustained in safety.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973; 38 FR 23405, Aug. 30, 1973]

§ 213.11 Restoration or renewal of track under traffic conditions.

If, during a period of restoration or renewal, track is under traffic conditions and does not meet all of the requirements prescribed in this part, the work and operations on the track must be under the continuous supervision of a person designated under § 213.7(a).

§ 213.13 Measuring track not under load.

When unloaded track is measured to determine compliance with requirements of this part, the amount of rail movement, if any, that occurs while the track is loaded must be added to the measurement of the unloaded track.

[38 FR 875, Jan. 5, 1973]

§ 213.15 Civil penalty.

(a) Any owner of track to which this part applies, or any person held by the Federal Railroad Administrator to be responsible under § 213.5(c), who violates any requirement prescribed in this part is subject to a civil penalty of at least $250 but not more than $2,500.

(b) For the purpose of this section, each day a violation persists shall be treated as a separate offense.

Exemptions.

(a) Any owner of track to which this part applies may petition the Federal Railroad Administrator for exemption from any or all requirements prescribed in this part.

(b) Each petition for exemption under this section must be filed in the manner and contain the information required by § 211.11 of this chapter.

(c) If the Administrator finds that an exemption is in the public interest and is consistent with railroad safety, he may grant the exemption subject to any conditions he deems necessary. Notice of each exemption granted is published in the FEDERAL REGISTER together with a statement of the reasons therefor.

Subpart B—Roadbed

§ 213.31 Scope.

This subpart prescribes minimum requirements for roadbed and areas immediately adjacent to roadbed.

§ 213.33 Drainage.

Each drainage or other water carrying facility under or immediately adjacent to the roadbed must be maintained and kept free of obstruction, to accommodate expected water flow for the area concerned.

§ 213.37 Vegetation.

Vegetation on railroad property which is on or immediately adjacent to roadbed must be controlled so that it does not—

(a) Become a fire hazard to track-carrying structures;

(b) Obstruct visibility of railroad signs and signals;

(c) Interfere with railroad employees performing normal trackside duties;

(d) Prevent proper functioning of signal and communication lines; or

(e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

Subpart C—Track Geometry

§ 213.51 Scope.

This subpart prescribes requirements for the gage, alinement, and surface of track, and the elevation of outer rails and speed limitations for curved track.

§ 213.53 Gage.

(a) Gage is measured between the heads of the rails at right angles to the rails in a plane five-eighths of an inch below the top of the rail head.

(b) Gage must be within the limits prescribed in the following table:

Class of track	The gage of tangent track must be—		The gage of curved track must be—	
	At least—	But not more than—	At least—	But not more than—
1	4' 8"	4' 9¾"	4' 8"	4' 9¾"
2 and 3	4' 8"	4' 9½"	4' 8"	4' 9¾"
4	4' 8"	4' 9¼"	4' 8"	4' 9½"
5	4' 8"	4' 9"	4' 8"	4' 9½"
6	4' 8"	4' 8¾"	4' 8"	4' 9"

§ 213.55 Alinement.

Alinement may not deviate from uniformity more than the amount prescribed in the following table:

Class of track	Tangent track: The deviation of the mid-offset from 62-foot line [1] may not be more than—	Curved track: The deviation of the mid-ordinate from 62-foot chord [2] may not be more than—
1	5"	5"
2	3"	3"
3	1¾"	1¾"
4	1½"	1½"
5	¾"	⅝"
6	½"	⅜"

[1] The ends of the line must be at points on the gage side of the line rail, five eighths of an inch below the top of the railhead. Either rail may be used as the line rail, however, the same rail must be used for the full length of that tangential segment of track.

[2] The ends of the chord must be at points on the gage side of the outer rail, five-eighths of an inch below the top of the railhead.

§ 213.57 Curves; elevation and speed limitations.

(a) Except as provided in § 213.63, the outside rail of a curve may not be lower than the inside rail or have more than 6 inches of elevation.

(b) The maximum allowable operating speed for each curve is determined by the following formula:

$$V_{max} = \sqrt{\frac{E_a + 3}{0.0007d}}$$

where

V_{max} = Maximum allowable operating speed (miles per hour).

E_a = Actual elevation of the outside rail (inches).

d = Degree of curvature (degrees).

Appendix A is a table of maximum allowable operating speed computed in accordance with this formula for various elevations and degrees of curvature.

§ 213.59 Elevation of curved track; runoff.

(a) If a curve is elevated, the full elevation must be provided throughout the curve, unless physical conditions do not permit. If elevation runoff occurs in a curve, the actual minimum elevation must be used in computing the maximum allowable operating speed for that curve under § 213.57(b).

(b) Elevation runoff must be at a uniform rate, within the limits of track surface deviation prescribed in § 213.63, and it must extend at least the full length of the spirals. If physical conditions do not permit a spiral long enough to accommodate the minimum length of runoff, part of the runoff may be on tangent track.

§ 213.61 Curve data for Classes 4 through 6 track.

(a) Each owner of track to which this part applies shall maintain a record of each curve in its Classes 4 through 6 track. The record must contain the following information:

(1) Location;
(2) Degree of curvature;
(3) Designated elevation;
(4) Designated length of elevation runoff; and
(5) Maximum allowable operating speed.

[38 FR 875, Jan. 5, 1973]

§ 213.63 Track surface.

Each owner of the track to which this part applies shall maintain the surface of its track within the limits prescribed in the following table:

Track surface	Class of track					
	1	2	3	4	5	6
The runoff in any 31 feet of rail at the end of a raise may not be more than	3½"	3"	2"	1½"	1"	½"
The deviation from uniform profile on either rail at the midordinate of a 62-foot chord may not be more than	3"	2¾"	2¼"	2"	1¼"	½"
Deviation from designated elevation on spirals may not be more than	1¾"	1½"	1¼"	1"	¾"	½"
ariation in cross level on spirals in any 31 feet may not be more than	2"	1¾"	1¼"	1"	¾"	½"
Deviation from zero cross level at any point on tangent or from designated elevation on curves between spirals may not be more than	3"	2"	1¾"	1¼"	1"	½"
The difference in cross level between any two points less than 62 feet apart on tangents and curves between spirals may not be more than	3"	2"	1¾"	1¼"	1"	½"

Subpart D—Track Structure

§ 213.101 Scope.

This subpart prescribes minimum requirements for ballast, crossties, track assembly fittings, and the physical condition of rails.

§ 213.103 Ballast; general.

Unless it is otherwise structurally supported, all track must be supported by material which will—

(a) Transmit and distribute the load of the track and railroad rolling equipment to the subgrade;

(b) Restrain the track laterally, longitudinally, and vertically under dynamic loads imposed by railroad rolling equipment and thermal stress exerted by the rails;

(c) Provide adequate drainage for the track; and

(d) Maintain proper track cross-level, surface, and alinement.

§ 213.105 Ballast; disturbed track.

If track is disturbed, a person designated under § 213.7 shall examine the track to determine whether or not the ballast is sufficiently compacted to perform the functions described in § 213.103. If the person making the examination considers it to be necessary in the interest of safety, operating speed over the disturbed segment of track must be

reduced to a speed that he considers safe.

§ 213.109 Crossties.

(a) Crossties may be made of any material to which rails can be securely fastened. The material must be capable of holding the rails to gage within the limits prescribed in § 213.53(b) and distributing the load from the rails to the ballast section.

(b) A timber crosstie is considered to be defective when it is—

(1) Broken through;

(2) Split or otherwise impaired to the extent it will not hold spikes or will allow the ballast to work through;

(3) So deteriorated that the tie plate or base of rail can move laterally more than one-half inch relative to the crosstie;

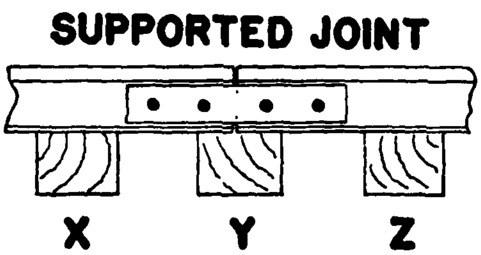
(4) Cut by the tie plate through more than 40 percent of its thickness; or

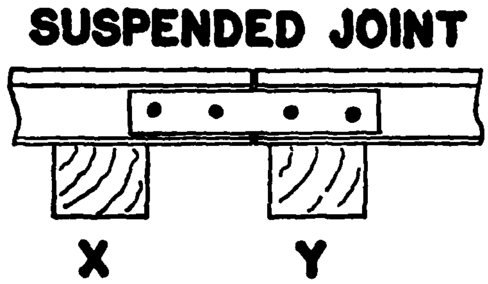
(5) Not spiked as required by § 213.127.

(c) If timber crossties are used, each 39 feet of track must be supported by nondefective ties as set forth in the following table:

Class of track	Minimum number of nondefective ties per 39 feet of track	Maximum distance between nondefective ties (center to center) (inches)
1	5	100
2, 3	8	70
4, 5	12	48
6	14	48

(d) If timber ties are used, the minimum number of nondefective ties under a rail joint and their relative positions under the joint are described in the following chart. The letters in the chart correspond to letters underneath the ties for each type of joint depicted.





Class of track	Minimum number of nondefective ties under a joint	Required position of nondefective ties	
		Supported joint	Suspended joint
1	1	X, Y, or Z	X or Y.
2, 3	1	Y	X or Y.
4, 5, 6	2	X and Y, or Y and Z.	X and Y.

(e) Except in an emergency or for a temporary installation of not more than 6-months duration, crossties may not be interlaced to take the place of switch ties.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973]

§ 213.113 Defective rails.

(a) When an owner of track to which this part applies learns, through inspection or otherwise, that a rail in that track contains any of the defects listed in the following table, a person designated under § 213.7 shall determine whether or not the track may continue in use. If he determines that the track may continue in use, operation over the defective rail is not permitted until—

(1) The rail is replaced; or

(2) The remedial action prescribed in the table is initiated:

Remedial Action

Defect	Length of defect (inch)		Percent of railhead cross-sectional area weakened by defect		If defective rail is not replaced, take the remedial action prescribed in note—
	More than	But not more than	Less than	But not less than	
Transverse fissure			20		B.
			100	20	B.
				100	A.
Compound fissure			20		B.
			100	20	B.
				100	A.
Detail fracture			20		C.
Engine burn fracture			100	20	D.
Defective weld				100	A, or E and H.
Horizontal split head	0	2			H and F.
	2	4			I and G.
Vertical split head	4				B.
	(Break out in railhead)				A.
Split web	0	½			H and F.
Piped rail	½	3			I and G.
Head web separation	3				B.
	(Break out in railhead)				A.
Bolt hole crack	0	½			H and F.
	½	1½			I and G.
	1½				B.
	(Break out in railhead)				A.
Broken base	0	6			E and I.
	6				(Replace rail).
Ordinary break					A or E.
Damaged rail					C.

NOTE:
A—Assign person designated under § 213.7 to visually supervise each operation over defective rail.
B—Limit operating speed to 10 m.p.h. over defective rail.
C—Apply joint bars bolted only through the outermost holes to defect within 20 days after it is determined to continue the track in use. In the case of classes 3 through 6 track, limit operating speed over defective rail to 30 m.p.h. until angle bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
D—Apply joint bars bolted only through the outermost holes to defect within 10 days after it is determined to continue the track in use. Limit operating speed over defective rail to 10 m.p.h. until angle bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
E—Apply joint bars to defect and bolt in accordance with § 213.121 (d) and (e).
F—Inspect rail 90 days after it is determined to continue the track in use.
G—Inspect rail 30 days after it is determined to continue the track in use.
H—Limit operating speed over defective rail to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
I—Limit operating speed over defective rail to 30 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.

(b) If a rail in classes 3 through 6 track or class 2 track on which passenger trains operate evidences any of the conditions listed in the following table, the remedial action prescribed in the table must be taken:

Condition	Remedial action	
	If a person designated under § 213.7 determines that condition requires rail to be replaced	If a person designated under § 213.7 determines that condition does not require rail to be replaced
Shelly spots	Limit speed to 20 m.p.h. and schedule the rail for replacement.	Inspect the rail for internal defects at intervals of not more than every 12 months.
Head checks		
Engine burn (but not fracture).		
Mill defect		
Flaking	do	Inspect the rail at intervals of not more than every 6 months.
Slivered		
Corrugated		
Corroded		

(c) As used in this section—

(1) "Transverse Fissure" means a progressive crosswise fracture starting from a crystalline center or nucleus inside the head from which it spreads outward as a smooth, bright, or dark, round or oval surface substantially at a right angle to the length of the rail. The distinguishing features of a transverse fissure from other types of fractures or defects are the crystalline center or nucleus and the nearly smooth surface of the development which surrounds it.

(2) "Compound Fissure" means a progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright, or dark surface progressing until substantially at a right angle to the length of the rail. Compound fissures require examination of both faces of the fracture to locate the horizontal split head from which they originate.

(3) "Horizontal Split Head" means a horizontal progressive defect originating inside of the rail head, usually one-quarter inch or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise of the rail when it reaches the side of the rail head.

(4) "Vertical Split Head" means a vertical split through or near the middle of the head, and extending into or through it. A crack or rust streak may show under the head close to the web or pieces may be split off the side of the head.

(5) "Split Web" means a lengthwise crack along the side of the web and extending into or through it.

(6) "Piped Rail" means a vertical split in a rail, usually in the web, due to failure of the sides of the shrinkage cavity in the ingot to unite in rolling.

(7) "Broken Base" means any break in the base of a rail.

(8) "Detail Fracture" means a progressive fracture originating at or near the surface of the rail head. These fractures should not be confused with transverse fissures, compound fissures, or other defects which have internal origins. Detail fractures may arise from shelly spots, head checks, or flaking.

(9) "Engine Burn Fracture" means a progressive fracture originating in spots where driving wheels have slipped on top of the rail head. In developing downward they frequently resemble the compound or even transverse fissure with which they should not be confused or classified.

(10) "Ordinary Break" means a partial or complete break in which there is no sign of a fissure, and in which none of the other defects described in this paragraph are found.

(11) "Damaged rail" means any rail broken or injured by wrecks, broken, flat, or unbalanced wheels, slipping, or similar causes.

(12) "Shelly spots" means a condition where a thin (usually three-eighths inch in depth or less) shell-like piece of surface metal becomes separated from the parent metal in the railhead, generally at the gage corner. It may be evidenced by a black spot appearing on the railhead over the zone of separation or a piece of metal breaking out completely, leaving a shallow cavity in the railhead. In the case of a small shell there may be no surface evidence, the existence of the shell being apparent only after the rail is broken or sectioned.

(13) "Head checks" mean hair fine cracks which appear in the gage corner of the rail head, at any angle with the length of the rail. When not readily visible the presence of the checks may often be detected by the raspy feeling of their sharp edges.

(14) "Flaking" means small shallow flakes of surface metal generally not more than one-quarter inch in length or width break out of the gage corner of the railhead.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973; 38 FR 1508, Jan. 15, 1973]

§ 213.115 Rail end mismatch.

Any mismatch of rails at joints may not be more than that prescribed by the following table:

Class of track	Any mismatch of rails at joints may not be more than the following—	
	On the trend of the rail ends (inch)	On the gage side of the rail ends (inch)
1	1/4	1/4
2	1/4	3/16
3	3/16	3/16
4, 5	1/8	1/8
6	1/8	1/8

§ 213.117 Rail end batter.

(a) Rail end batter is the depth of depression at one-half inch from the rail end. It is measured by placing an 18-inch straightedge on the tread on the rail end, without bridging the joint, and measuring the distance between the bottom of the straightedge and the top of the rail at one-half inch from the rail end.

(b) Rail end batter may not be more than that prescribed by the following table:

Class of track	*Rail end batter may not be more than— (inch)*
1	1/2
2	3/8
3	3/8
4	1/4
5	1/8
6	1/8

§ 213.119 Continuous welded rail.

(a) When continuous welded rail is being installed, it must be installed at, or adjusted for, a rail temperature range

that should not result in compressive or tensile forces that will produce lateral displacement of the track or pulling apart of rail ends or welds.

(b) After continuous welded rail has been installed it should not be disturbed at rail temperatures higher than its installation or adjusted installation temperature.

§ 213.121 Rail joints.

(a) Each rail joint, insulated joint, and compromise joint must be of the proper design and dimensions for the rail on which it is applied.

(b) If a joint bar on classes 3 through 6 track is cracked, broken, or because of wear allows vertical movement of either rail when all bolts are tight, it must be replaced.

(c) If a joint bar is cracked or broken between the middle two bolt holes it must be replaced.

(d) In the case of conventional jointed track, each rail must be bolted with at least two bolts at each joint in classes 2 through 6 track, and with at least one bolt in class 1 track.

(e) In the case of continuous welded rail track, each rail must be bolted with at least two bolts at each joint.

(f) Each joint bar must be held in position by track bolts tightened to allow the joint bar to firmly support the abutting rail ends and to allow longitudinal movement of the rail in the joint to accommodate expansion and contraction due to temperature variations. When out-of-face, no-slip, joint-to-rail contact exists by design, the requirements of this paragraph do not apply. Those locations are considered to be continuous welded rail track and must meet all the requirements for continuous welded rail track prescribed in this part.

(g) No rail or angle bar having a torch cut or burned bolt hole may be used in classes 3 through 6 track.

§ 213.123 Tie plates.

(a) In classes 3 through 6 track where timber crossties are in use there must be tie plates under the running rails on at least eight of any 10 consecutive ties.

(b) Tie plates having shoulders must be placed so that no part of the shoulder is under the base of the rail.

§ 213.125 Rail anchoring.

Longitudinal rail movement must be effectively controlled. If rail anchors which bear on the sides of ties are used for this purpose, they must be on the same side of the tie on both rails.

§ 213.127 Track spikes.

(a) When conventional track is used with timber ties and cut track spikes, the rails must be spiked to the ties with at least one line-holding spike on the gage side and one line-holding spike on the field side. The total number of track spikes per rail per tie, including plate-holding spikes, must be at least the number prescribed in the following table:

MINIMUM NUMBER OF TRACK SPIKES PER RAIL PER TIE, INCLUDING PLATE-HOLDING SPIKES

Class of track	Tangent track and curved track with not more than 2° of curvature	Curved track with more than 2° but not more than 4° of curvature	Curved track with more than 4° but not more than 6° of curvature	Curved track with more than 6° of curvature
1	2	2	2	2
2	2	2	2	3
3	2	2	2	3
4	2	2	3	----------
5	2	3	----------	----------
6	2	----------	----------	----------

(b) A tie that does not meet the requirements of paragraph (a) of this section is considered to be defective for the purposes of § 213.109(b).

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.129 Track shims.

(a) If track does not meet the geometric standards in Subpart C of this part and working of ballast is not possible due to weather or other natural conditions, track shims may be installed to correct the deficiencies. If shims are used, they must be removed and the track resurfaced as soon as weather and other natural conditions permit.

(b) When shims are used they must be—

(1) At least the size of the tie plate;

(2) Inserted directly on top of the tie, beneath the rail and tie plate;

(3) Spiked directly to the tie with spikes which penetrate the tie at least 4 inches.

(c) When a rail is shimmed more than 1½ inches, it must be securely braced on at least every third tie for the full length of the shimming.

(d) When a rail is shimmed more than 2 inches a combination of shims and 2-

inch or 4-inch planks, as the case may be, must be used with the shims on top of the planks.

§ 213.131 Planks used in shimming.

(a) Planks used in shimming must be at least as wide as the tie plates, but in no case less than 5½ inches wide. Whenever possible they must extend the full length of the tie. If a plank is shorter than the tie, it must be at least 3 feet long and its outer end must be flush with the end of the tie.

(b) When planks are used in shimming on uneven ties, or if the two rails being shimmed heave unevenly, additional shims may be placed between the ties and planks under the rails to compensate for the unevenness.

(c) Planks must be nailed to the ties with at least four 8-inch wire spikes. Before spiking the rails or shim braces, planks must be bored with ⅝-inch holes.

§ 213.133 Turnouts and track crossings generally.

(a) In turnouts and track crossings, the fastenings must be intact and maintained so as to keep the components securely in place. Also, each switch, frog, and guard rail must be kept free of obstructions that may interfere with the passage of wheels.

(b) Classes 4 through 6 track must be equipped with rail anchors through and on each side of track crossings and turnouts, to restrain rail movement affecting the position of switch points and frogs.

(c) Each flangeway at turnouts and track crossings must be at least 1½ inches wide.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.135 Switches.

(a) Each stock rail must be securely seated in switch plates, but care must be used to avoid canting the rail by overtightening the rail braces.

(b) Each switch point must fit its stock rail properly, with the switch stand in either of its closed positions to allow wheels to pass the switch point. Lateral and vertical movement of a stock rail in the switch plates or of a switch plate on a tie must not adversely affect the fit of the switch point to the stock rail.

(c) Each switch must be maintained so that the outer edge of the wheel tread cannot contact the gage side of the stock rail.

(d) The heel of each switch rail must be secure and the bolts in each heel must be kept tight.

(e) Each switch stand and connecting rod must be securely fastened and operable without excessive lost motion.

(f) Each throw lever must be maintained so that it cannot be operated with the lock or keeper in place.

(g) Each switch position indicator must be clearly visible at all times.

(h) Unusually chipped or worn switch points must be repaired or replaced. Metal flow must be removed to insure proper closure.

§ 213.137 Frogs.

(a) The flangeway depth measured from a plane across the wheel-bearing area of a frog on class 1 track may not be less than 1⅜ inches, or less than 1½ inches on classes 2 through 6 track.

(b) If a frog point is chipped, broken, or worn more than five-eighths inch down and 6 inches back, operating speed over that frog may not be more than 10 miles per hour.

(c) If the tread portion of a frog casting is worn down more than three-eighths inch below the original contour, operating speed over that frog may not be more than 10 miles per hour.

§ 213.139 Spring rail frogs.

(a) The outer edge of a wheel tread may not contact the gage side of a spring wing rail.

(b) The toe of each wing rail must be solidly tamped and fully and tightly bolted.

(c) Each frog with a bolt hole defect or head-web separation must be replaced.

(d) Each spring must have a tension sufficient to hold the wing rail against the point rail.

(e) The clearance between the hold-down housing and the horn may not be more than one-fourth of an inch.

§ 213.141 Self-guarded frogs.

(a) The raised guard on a self-guarded frog may not be worn more than three-eighths of an inch.

(b) If repairs are made to a self-guarded frog without removing it from service, the guarding face must be restored before rebuilding the point.

§ 213.143 Frog guard rails and guard faces; gage.

The guard check and guard face gages in frogs must be within the limits prescribed in the following table:

Class of track	Guard check gage: The distance between the gage line of a frog to the guard line [1] of its guard rail or guarding face, measured across the track at right angles to the gage line, [2] may not be less than—	Guard face gage: The distance between guard lines, [1] measured across the track at right angles to the gage line, [2] may not be more than—
1	4′ 6⅛″	4′ 5¼″
2	4′ 6¼″	4′ 5⅛″
3, 4	4′ 6⅜″	4′ 5⅛″
5, 6	4′ 6½″	4′ 5″

[1] A line along that side of the flangeway which is nearer to the center of the track and at the same elevation as the gage line.

[2] A line ⅝ inch below the top of the center line of the head of the running rail, or corresponding location of the tread portion of the track structure.

Subpart E—Track Appliances and Track-Related Devices

§ 213.201 Scope.

This subpart prescribes minimum requirements for certain track appliances and *track-related devices.*

§ 213.205 Derails.

(a) Each derail must be clearly visible. When in a *locked position* a derail must be free of any lost motion which would allow it to be operated without removing the lock.

(b) When the lever of a remotely controlled derail is operated and latched it must actuate the derail.

§ 213.207 Switch heaters.

The operation of a switch heater must not interfere with the proper operation of the switch or otherwise jeopardize the safety of railroad equipment.

Subpart F—Inspection

§ 213.231 Scope.

This subpart prescribes requirements for the frequency and manner of inspecting track to detect deviations from the standards prescribed in this part.

§ 213.233 Track inspections.

(a) All track must be inspected in accordance with the schedule prescribed in paragraph (c) of this section by a person designated under § 213.7.

(b) Each inspection must be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part. However, mechanical or electrical inspection devices approved by the Federal Railroad Administrator may be used to supplement visual inspection. If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 miles per hour when passing over track crossings, highway crossings, or switches.

(c) Each track inspection must be made in accordance with the following *schedule:*

Class of track	Type of track	Required frequency
1, 2, 3	Main track and sidings.	*Weekly* with at least 3 calendar days interval between inspections, or *before use*, if the track is used less than once a week, or *twice weekly* with at least 1 calendar day interval between inspections, if the track carries passenger trains or more than 10 million gross tons of traffic during the preceding calendar year.
1, 2, 3	Other than main track and sidings.	*Monthly* with at least 20 calendar days interval between inspections.
4, 5, 6		*Twice weekly* with at least 1 calendar day interval between inspections.

(d) If the person making the inspection finds a deviation from the requirements of this part, he shall immediately initiate remedial action.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.235 Switch and track crossing inspections.

(a) Except as provided in paragraph (b) of this section, each switch and track crossing must be inspected on foot at least monthly.

(b) In the case of track that is used less than once a month, each switch and track crossing must be inspected on foot before it is used.

§ 213.237 Inspection of rail.

(a) In addition to the track inspections required by § 213.233, at least once a

year a continuous search for internal defects must be made of all jointed and welded rails in Classes 4 through 6 track, and Class 3 track over which passenger trains operate. However, in the case of a new rail, if before installation or within 6 months thereafter it is inductively or ultrasonically inspected over its entire length and all defects are removed, the next continuous search for internal defects need not be made until 3 years after that inspection.

(b) Inspection equipment must be capable of detecting defects between joint bars, in the area enclosed by joint bars.

(c) Each defective rail must be marked with a highly visible marking on both sides of the web and base.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.239 Special inspections.

In the event of fire, flood, severe storm, or other occurrence which might have damaged track structure, a special inspection must be made of the track involved as soon as possible after the occurrence.

§ 213.241 Inspection records.

(a) Each owner of track to which this part applies shall keep a record of each inspection required to be performed on that track under this subpart.

(b) Each record of an inspection under §§ 213.233 and 213.235 shall be prepared on the day the inspection is made and signed by the person making the inspection. Records must specify the track inspected, date of inspection, location and nature of any deviation from the requirements of this part, and the remedial action taken by the person making the inspection. The owner shall retain each record at its division headquarters for at least 1 year after the inspection covered by the record.

(c) Rail inspection records must specify the date of inspection, the location, and nature of any internal rail defects found, and the remedial action taken and the date thereof. The owner shall retain a rail inspection record for at least 2 years after the inspection and for 1 year after remedial action is taken.

(d) Each owner required to keep inspection records under this section shall make those records available for inspection and copying by the Federal Railroad Administrator.

Appendix A—Maximum Allowable Operating Speeds for Curved Track

Elevation of outer rail (inches)

Degree of Curvature	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Maximum allowable operating speed (mph)												
0°30′	93	100	107										
0°40′	80	87	93	98	103	109							
0°50′	72	78	83	88	93	97	101	106	110				
1°00′	66	71	76	80	85	89	93	96	100	104	107	110	
1°15′	59	63	68	72	76	79	83	86	89	93	96	99	101
1°30′	54	58	62	66	69	72	76	79	82	85	87	90	93
1°45′	50	54	57	61	64	67	70	73	76	78	81	83	86
2°00′	46	50	54	57	60	63	66	68	71	73	76	78	80
2°15′	44	47	50	54	56	59	62	64	67	69	71	74	76
2°30′	41	45	48	51	54	56	59	61	63	66	68	70	72
2°45′	40	43	46	48	51	54	56	58	60	62	65	66	68
3°00′	38	41	44	46	49	51	54	56	58	60	62	64	66
3°15′	36	39	42	45	47	49	51	54	56	57	59	61	63
3°30′	35	38	40	43	45	47	50	52	54	55	57	59	61
3°45′	34	37	39	41	44	46	48	50	52	54	55	57	59
4°00′	33	35	38	40	42	44	46	48	50	52	54	55	57
4°30′	31	33	36	38	40	42	44	45	47	49	50	52	54
5°00′	29	32	34	36	38	40	41	43	45	46	48	49	51
5°30′	28	30	32	34	36	38	40	41	43	44	46	47	48
6°00′	27	29	31	33	35	36	38	39	41	42	44	45	46
6°30′	26	28	30	31	33	35	36	38	39	41	42	43	45
7°00′	25	27	29	30	32	34	35	36	38	39	40	42	43
8°00′	23	25	27	28	30	31	33	34	35	37	38	39	40
9°00′	22	24	25	27	28	30	31	32	33	35	36	37	38
10°00′	21	22	24	25	27	28	29	31	32	33	34	35	36
11°00′	20	21	23	24	26	27	28	29	30	31	32	33	34
12°00′	19	20	22	23	24	26	27	28	29	30	31	32	3

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

APPENDIX B

PROPOSED RAIL OUTLOADING PROCEDURE FOR A MOBILIZATION MOVE AT FORT LEWIS

Maximum rail outloading operations use a cyclic schedule to minimize conflicts and improve control. The recommended rail outloading plan, Plan 5, for Main Post and the Logistics Center is shown in figures 40 and 41, respectively. Plan 5 assumes that approximately 291 railcars (94 railcars from Fort Lewis Main Post and 197 railcars from Fort Lewis Logistics Center) will be outloaded per day from two separate areas within the Fort Lewis installation. These two rail outloading areas are not interconnected by internal rail trackage and therefore will be analyzed individually. The simulation begins with the assumption that it takes several days to accumulate the necessary number of railcars to start full-scale outloading operations. The switching locomotives (SL) position the arriving cars at the designated loadout sites according to a preconceived plan. Simultaneously, the equipment to be loaded aboard the cars is prepared and staged. Personnel should be used to throw switches and act as road guards at all rail/highway crossings to reduce delays and insure a safer operation. The particular outloading scheme for Fort Lewis Main Post and Fort Lewis Logistics Center are described herewith.

Fort Lewis Main Post

Empty railcars have been accumulating for several days and have been spotted at loading sites, tracks L1 through L6 (see fig 2). The number of railcars in position is 94, and the general operation plan is that the previously mentioned loading sites will be used for loading on a cyclic basis. When the unit equipment is loaded on the railcars, the installation 100-ton switching engine will move those railcars to the loaded storage track (S1), where they will be picked up by the BN main line (ML) engines for movement to the assigned east coast POE. When the ML engines come to pick up the loaded cars, they will bring empties for the next cycle and move them to the empty storage track (E1). The installation's switching engine will then spot these empty railcars at the appropriate tracks. There will be two outgoing trains of loaded unit equipment per 24-hour period.

Loading, blocking, and bracing of the empty cars at the loading sites will be accomplished during daylight hours and is expected to last about 7 hours. The switching operations will follow and will be carried out until they are completed.

LEGEND	
C	COUPLE
UC	UNCOUPLE
TR	TRANSIT
L	LOADED
E	EMPTY
39	NUMBER OF RAILCARS
(15)	TIME EXPENDED IN MIN.
L_1	TRACK LOCATION
MN	MAIN
TRK	TRACK
SB	SET BRAKE
WT	WAIT
SL	SWITCHING LOCOMOTIVE
ML	MAIN LINE LOCOMOTIVE
$\boxed{13}$	EMPTY RAILCARS
CO-1	CROSS OVER TRACK 1
DY	DU PONT CLASSIFICATION YD.

NOTE

1. AN EXTRA BRAKEMAN GOES TO EACH SITE PRIOR TO ARRIVAL OF SWITCHING ENGINE TO BEGIN RELEASING MECHANICAL BRAKES ON LOADED CARS TO REDUCE COUPLING TIME.

ELAPSED TIME

TIME IN HOURS

100 TON SL#1	OPERATION
	TIME (MINUTES)
	TRACK LOCATION
	NUMBER OF RAILCA

CAP 57'	DESCRIPTION	TRK NO	CA CA
	MAIN FORT LEWIS PRIORITY OF USE LOADING SITE		
9	TRK 6A	L1	9
12	TRK 6B	L2	1
24	TRK 6	L3	2
14	TRK 5	L4	1
15	TRK 4	L5	1
20	TRK 3	L6	2
	LOADED STORAGE		
	TRACK 2 BETWEEN THE ROUND HOUSE TRACK & TRACK 5	S1	
	EMPTY STORAGE		
	TRACK 1 BETWEEN THE ROUND HOUSE TRACK & TRACK 2 & 3	E1	
		ET2	

TIME IN HOURS

IME | SINCE LOADING, BLOCKING AND BRACING COMPLETED (1)

JRS 0700 0800

ATION	C-24-L	TR	UC-24-L	TR	C-9-L	TR	UC-9-L	TR
(MINUTES)	(10)	(18)	(5)	(16)	(5)	(20)	(5)	(17)
LOCATION	L3	S_1 @ CO-1	S_1	L1	L1	S_1 @ CO-2	S_1	L2
ER OF RAILCARS	24	24	0	0	9	9	0	0

	TRK NO	CAP CARS	
E			
	L1	9	0
	L2	12	
	L3	24	0
	L4	14	
	L5	15	
	L6	20	

24 33

0800

2 HRS

0900 1000

C-12-L	TR	UC-12-L	TR	WAIT	TR	C-24-E	TR	UC-24-E	TR	C-20-L	TR	UC-20-L	TR
(5)	(24)	(5)	(8)		(5)	(10)	(7)	(5)	(5)	(10)	(9)	(5)	(5
L2	S_1 @ CO-3	S_1	L6		E1	E1	ET2	ET2	L6	L6	S_1@CO-1	S_1	ET
12	12	0	0		0	24	24	0	0	20	20	0	0

C-UC CABOOSE

ML'S ARRIVE AT CO-3 WITH 45 EMPTY RAILCARS ML#1	UC-45	TR	C-45-L	TR	UC-45		C-46
	(5)	(5)	(15)	(15)	(5)	(5)	(10)
	E-1	S1 @ CO-3	S1	DUPONT YARD	DY	DY	DY
	0	0	45	45	0	0	46

0

0

45 0 20

45 21

24

0900 1000

Figure 40. Rail ou

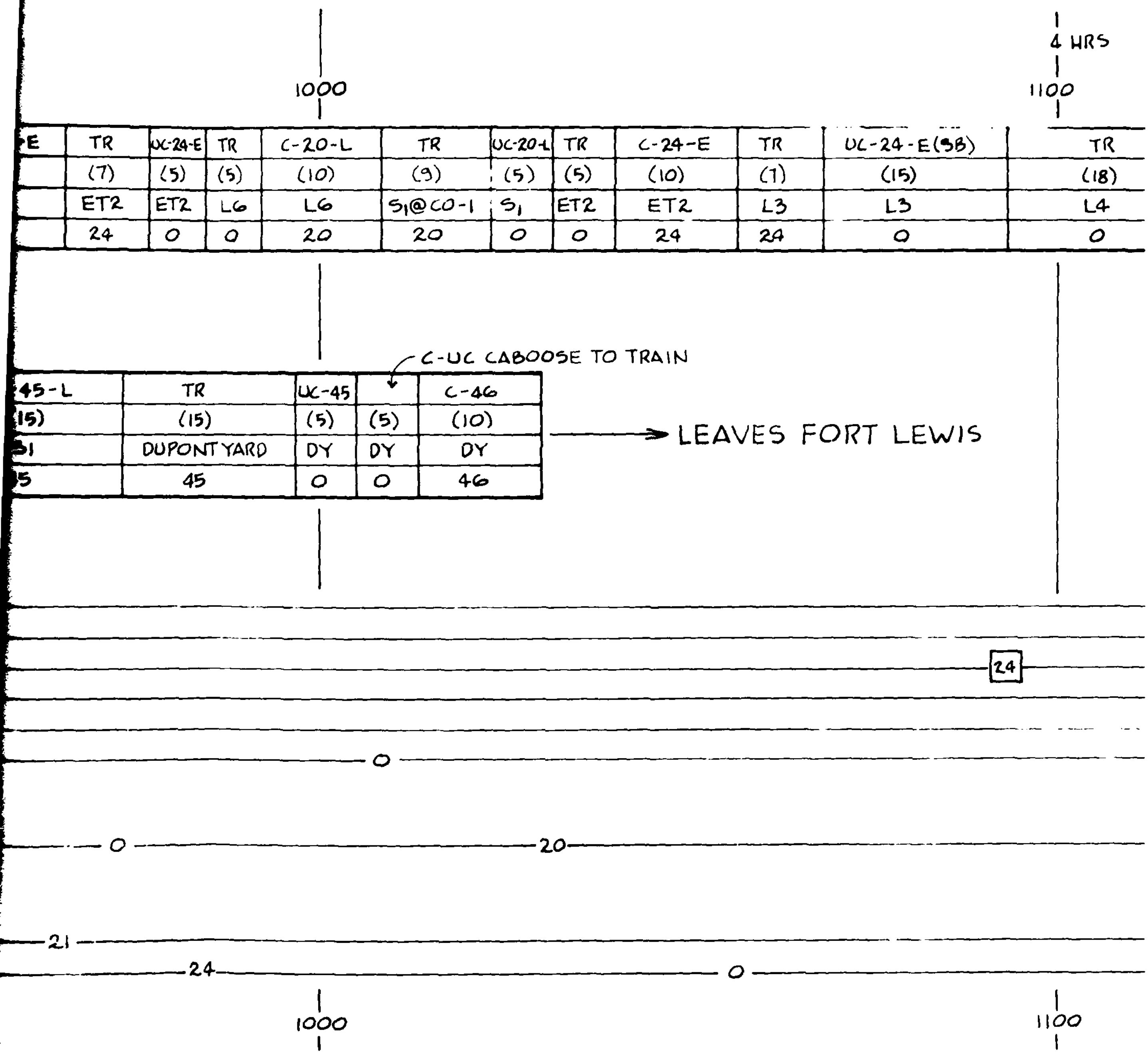


Figure 40. Rail outloading simulation, Main Post, Plan 5.

1200

	C-14-L	TR	UC-14-L	TR	C-21-E	TR	UC-21-E	TR	C-15-L	TR	C-34-L	UC-
	(5)	(6)	(5)	(5)	(5)	(10)	(5)	(5)	(10)	(10)	(10)	(
	L4	S1@CO2	S_1	E1	E1	ET2	ET2	L5	L5	S_1@CO-3	S_1	S
	14	14	0	0	21	21	0	0	15	15	49	[illegible]

ML'S ARRIVE AT CO-3
WITH 49 EMPTY RAILCARS
ML#2

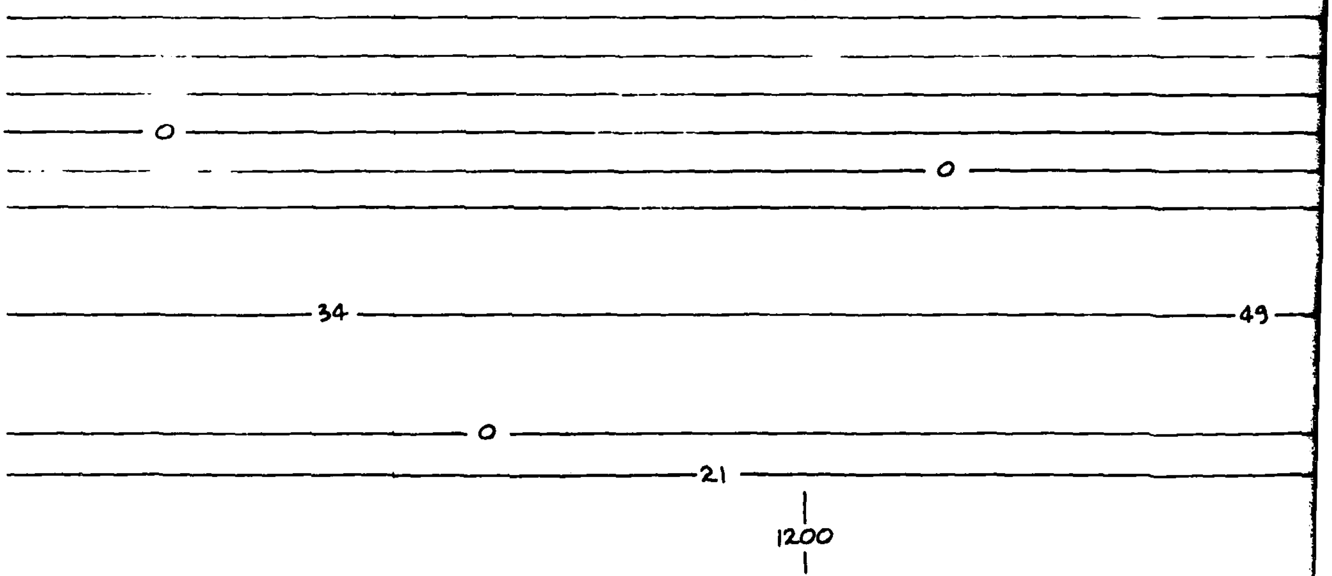


Figure 40 - Continued.

6 HRS

1300 | | | | | | | | 1400 |
|---|---|---|---|---|---|---|---|---|---|
| UC-49-L | TR | C-21-E | TR | UC-12-E (SB) | TR | UC-9-E (SB) | TR | C-35-E | TR |
| (10) | (15) | (5) | (11) | (15) | (5) | (12) | (15) | (10) | (9) |
| S_1 | ET2 | ET2 | L2 | L2 | L1 | L1 | E1 | E1 | L6 |
| 0 | 0 | 21 | 21 | 9 | 9 | 0 | 0 | 35 | 35 |

C-UC CABOOSE TO TRAIN

-3	UC-49-E	TR	C-49-L	TR	UC-49-L		C-50
CARS	(5)	(5)	(15)	(15)	(5)	(5)	(10)
	E1	S_1	S_1	DU PONT YARD	DY	DY	DY
	0	0	49	49	0	0	50

→ LEAVES FORT LEWIS

9

12

9 — 0

49 — 14

0

1300

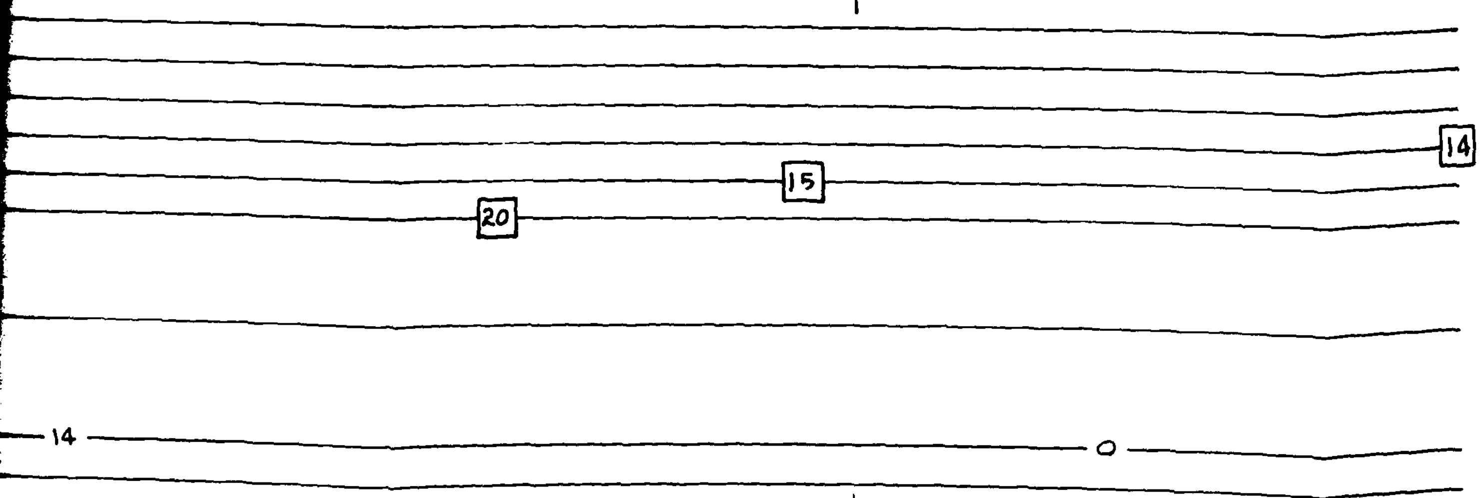
1400

8 HRS

1500

E	TR	UC-20-E (SB)	TR	UC-15-E (SB)	TR	C-14-E	TR	UC-14-E (SB)
	(9)	(20)	(5)	(15)	(15)	(5)	(10)	(15)
	L6	L6	L5	L5	E1	E1	L4	L4
	35	15	15	0	0	14	14	0

RT LEWIS



1500

The switching operation begins at track L3, where 24 loaded railcars are picked up and transported to loaded storage track (S1). Crossing over to track 1 at crossover 1 (see fig 2), the switching engine transits to track L1, picks up nine loaded cars, and positions them on track S1 at crossover 2. Switch engine 1 then transits to track L2, couples with 12 loaded railcars, places these cars on track S1 at crossover 3, and then proceeds to track L6 to wait for the arrival of the ML locomotives. The ML engines arrive about 9-1/4 hours (elapsed time) after the start of the operation and push the train, with 45 empty railcars, to the empty storage track (E1); pick up the loaded railcars on S1 by using the crossover track 3, and transit to the Dupont Classification Yard, where the caboose is attached before the train leaves for the assigned POE. After the ML engines uncouple the empty railcars, the SL1 proceeds to E1 and picks up 24 empty cars. These empty cars are then placed on the temporary empty storage track (ET2) (see fig 2). The SL1 then moves to track L6, couples with 20 loaded railcars, and places them on S1. Switching engine then travels back to ET2, couples with 24 empty railcars, and moves the cars to L3. The switch engine then picks up 14 loaded railcars at L4 and spots them on S1. It proceeds to E1, picks up the remaining 21 empty cars, and moves them to ET2 before it transits to L5 and couples with 15 loaded railcars. These loaded cars are then positioned on S1 with the other 34 loaded railcars, for a total of 49 railcars on S1. The switch engine then proceeds to ET2, couples with 21 empty railcars, and places 12 railcars on L2 and nine railcars on L1. Meanwhile, ML engines arrive on Fort Lewis about 12-1/2 hours (elapsed time) after the start of the operation and position the empty railcars on track E1. They then travel to S1 and couple with 49 loaded railcars before moving to the Dupont Classification Yard, where the caboose is attached to the train.

After the switch engine has placed the empty railcars on track L1, it transits to E1 and picks up 35 empty railcars. The switch engine then spots 20 and 15 empty railcars, at tracks L6 and L5, respectively. After the brake has been set, the SL1 transits back to E1 and picks up the remaining 14 empty railcars and positions them on track L4. The simulation indicates that the time required for a complete cycle is 15 hours 35 minutes.

Fort Lewis Logistics Center

Empty railcars are accumulated for several days and are spotted at the loading site - tracks L1 through L6 (see fig 3). The number of railcars in position is 197, and the loading sites previously mentioned will be used for loading on a cyclic basis. When the unit equipment is loaded on railcars, the BN main line (ML) engines will pick up the loaded railcars for movement to the assigned POE. This will be done after the BN main line

ELAPSED TIME | SINCE LOADING, BLOCKING AND BRAC

TIME IN HOURS 0700

LEGEND	
C	COUPLE
UC	UNCOUPLE
TR	TRANSIT
L	LOADED
E	EMPTY
39	NUMBER OF RAILCARS
(15)	TIME EXPENDED IN MIN
L_1	TRACK LOCATION
MN	MAIN
TRK	TRACK
SB	SET BRAKE
WT	WAIT
SL	SWITCHING LOCO
ML	MAIN LINE LOCO.
15	EMPTY RAILCARS
CO-1	CROSS OVER TRACK 1
CY	DUPONT CLASSIF. YARD

NOTE

(1) AN EXTRA BRAKE MAN GOES TO EACH SITE PRIOR TO ARRIVAL OF SWITCHING ENGINE TO BEGIN RELEASING MECHANICAL BRAKES ON LOADED CARS TO REDUCE COUPLING TIME.

80 TON SL #2	OPERATION	TR	C CABOOSE	TR
	TIME (MINUTES)	(5)	(5)	(5)
	TRACK LOCATION	E_1	E_1	TRK 2
	NUMBER RAILCARS	0	1	1

80 TON SL #3	OPERATION
	TIME (MINUTES)
	TRACK LOCATION
	NUMBER RAILCARS

ML'S ARRIVE AT E_1 WITH 67 RAILCARS ML #1	OPERATION	UC-21-E	TR	UC-20-E	TR	UC-18-E	TR	UC-8-E
	TIME (MINUTES)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
	TRACK LOCATION	E_1	E_2	E_2	E_3	E_3	E_4	E_4
	NUMBER RAILCARS	46	46	26	26	8	8	0

CAP 57'	DESCRIPTION	TRK NO	CAP CARS	
	FORT LEWIS LOGISTICS CENTER PRIORITY OF USE LOADING SITES			
40	TRK 11	L_1	40	
40	TRK 10	L_2	40	
40	TRK 9	L_3	40	
40	TRK 12	L_4	40	
25	TRK 6	L_5	25	
12	TRK 3	L_6	12	
	EMPTY STORAGE			
22	TRK 13	E_1	0	21 20
20	TRK 14	E_2	0	20
18	TRK 15	E_3	0	18
18	TRK 16	E_4	0	8
	TRK 1	ET5	0	

TIME IN HOURS 0700

BLOCKING AND BRACING COMPLETED (1)

0800

2 HRS

0900

WAIT

TR	C-UC-1E	C-SL#2	TR	C-20-E	TR	C-20-E
(5)	(5)	(5)	(5)	(10)	(5)	(10)
MN	MN	MN	E_1	E_1	E_2	E_2
1	0	0	0	20	20	40

WAIT

TR	C-SL#1
(5)	(5)
MN	MN
0	1

TR	UC-18-E	TR	UC-8-E	TR	C-40-L	TR	C-25-L	TR	C-1-E
(5)	(5)	(5)	(5)	(6)	(15)	(10)	(10)	(15)	(5)
[illegible]	E_3	E_4	E_4	L_1	L_1	L_4	L_4	MN	MN
[illegible]	8	8	0	0	40	40	65	65	66

→ LEAVES FT. LEWIS

0

15

0

18

8

0800

0900

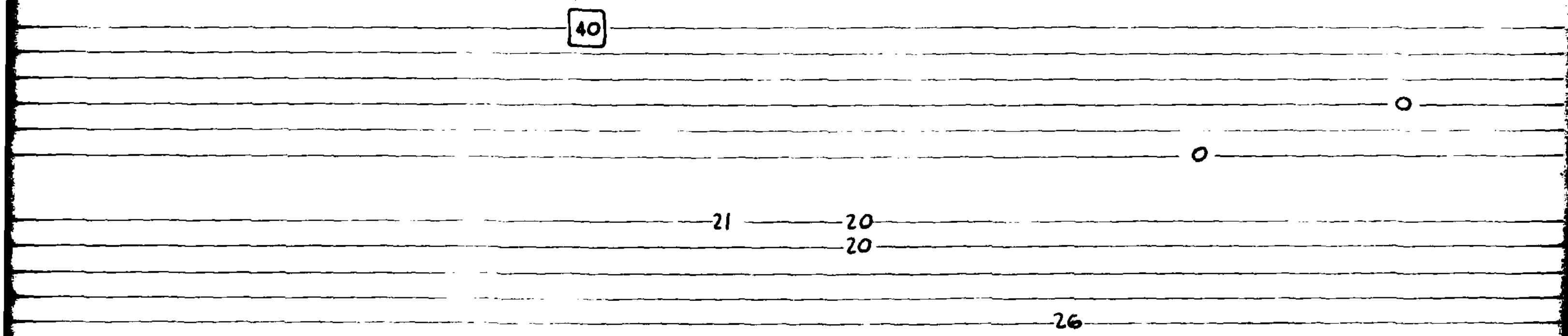
4 HRS

1000 | 1100

UC-40-E (5B)	TR	UC-1	TR	CABOOSE	TR	WAIT
(40)	(5)	(5)	(5)	(5)	(5)	
L_1	T_2	T_2	E_1	E_1	TRK 2	
O	O	O	O	1	1	

SL#3	WAIT

ML'S ARRIVE AT E_1 WITH 67 RAILCARS ML # 2	OPERATION	UC-21-E	TR	UC-20-E	TR	UC-26-E	TR	C-12-L	TR	C-15-L	TR
	TIME (MINUTES)	(5)	(5)	(5)	(10)	(5)	(5)	(5)	(10)	(5)	(10)
	TRACK LOCATION	E_1	E_2	E_2	ET5	ET5	L_6	L_6	L_4	L_4	L_2
	NUMBER RAILCARS	46	46	26	26	O	O	12	12	27	27



1000 | 1100

Figure 41. Rail outloading simulation, Logistics Center, Plan 5.

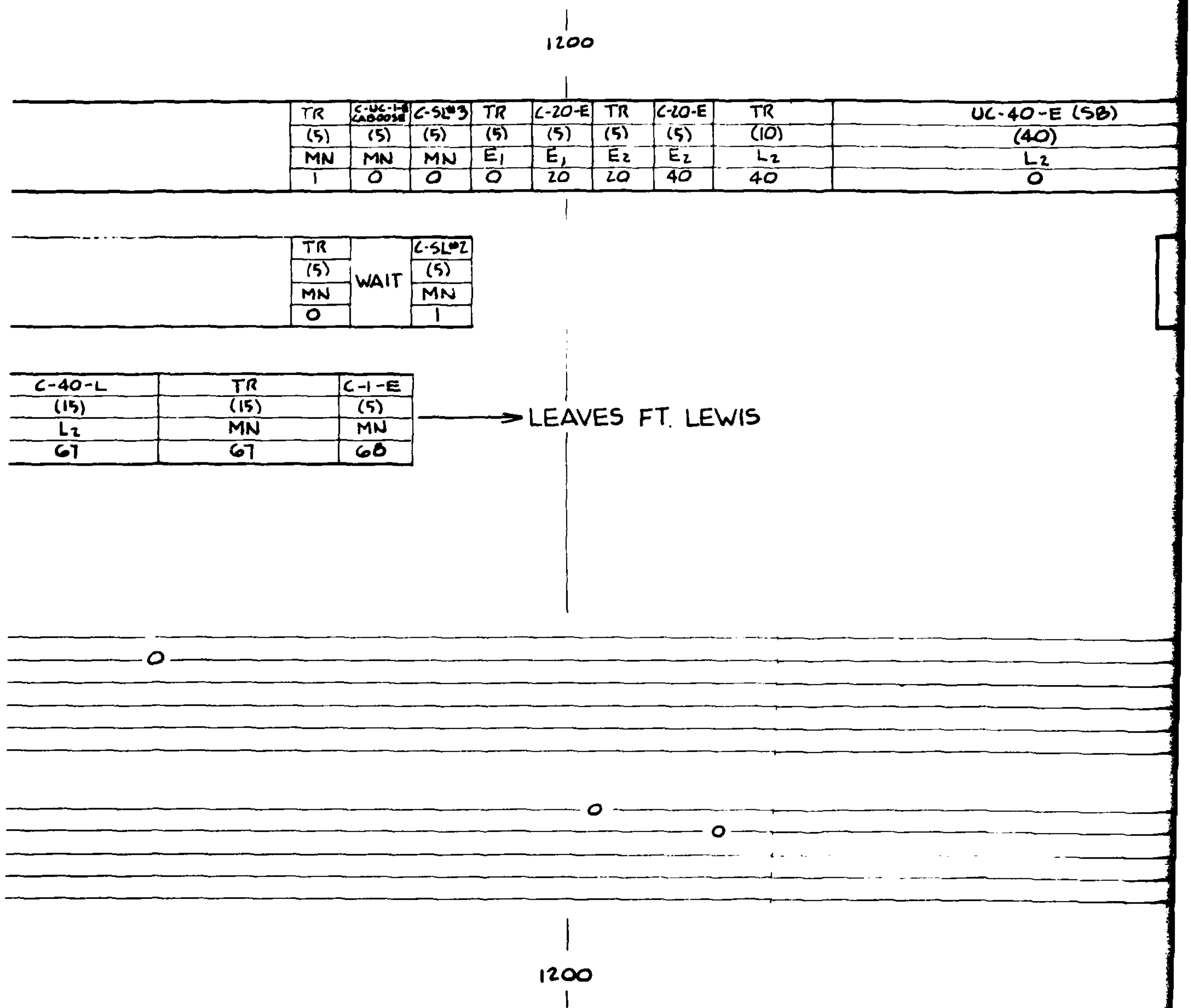


Figure 41 - Continued.

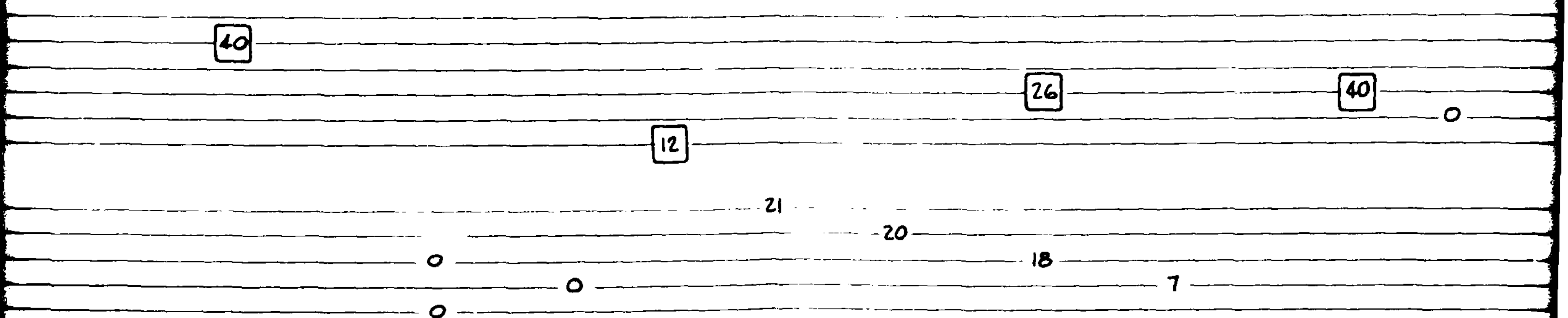
6 HRS

1300 1400

UC-SL#3	TR	C-18-E	TR	C-8-E	TR	UC-26-E (SB)	TR	WAIT
(5)	(5)	(5)	(5)	(5)	(10)	(26)	(5)	
L_2	E_3	E_3	E_4	E_4	L_4	L_4	TRK 2	
0	0	18	18	26	26	0	0	

SL#3	UC-SL#2	TR	C-26-E	TR	UC-12-E (SB)	WAIT	TR	UC-14-E (SB)	TR
	(5)	(5)	(5)	(5)	(12)		(5)	(14)	(5)
	L_2	ET5	ET5	L_6	L_6		L_4	L_4	TRK 2
	0	0	26	26	14		14	0	0

ML'S ARRIVE AT E_1 WITH 66 RAILCAR ML #3	OPERATION	UC-21-E	TR	UC-20-E	TR	UC-18-E	TR	UC-7-E	TR	C-25-L	TR
	TIME (MINUTES)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(10)	(10)	(10)
	TRACK LOCATION	E_1	E_2	E_2	E_3	E_3	E_4	E_4	L_5	L_5	L_3
	NUMBER TRACKS	45	45	25	25	7	7	0	0	25	25



1300 1400

8 HRS

1500 | 1600

TR	C-CABOOSE	WAIT	TR	C-UC-E CABOOSE	C-SL#3	TR	C-20-E	TR	C-20-E	TR	UC-40-E (SB)
(5)	(5)		(5)	(5)	(5)	(5)	(5)	(5)	(5)	(10)	(40)
E_1	E_1		MN	MN	MN	E_1	E_1	E_2	E_2	L_3	L_3
0	1		1	0	0	0	20	20	40	40	0

WAIT	TR	C-SL#2
	(5)	(5)
	MN	MN
	0	0

TR	C-40-L	TR	C-1-E CABOOSE
(10)	(15)	(15)	(5)
L_3	L_3	MN	MN
25	65	65	68

→ LEAVES FT. LEWIS

0

0

20

0

0

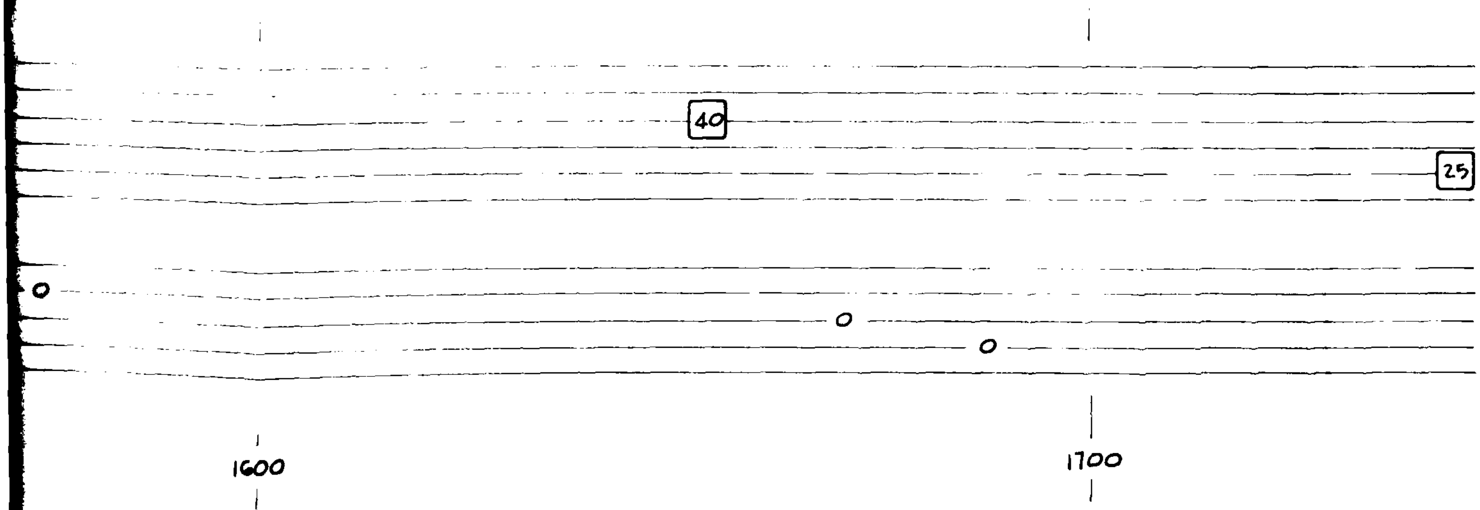
1500 | 1600

10 HRS

1600 1700

0-E	TR	UC-40-E (SB)	TR	C-18-E	TR	C-7-E	TR	UC-25-E (SB)
5)	(10)	(40)	(5)	(5)	(5)	(5)	(10)	(25)
2	L_3	L_3	E_3	E_3	E_4	E_4	L_5	L_5
0	40	0	0	18	18	25	25	0

LEWIS



AD-A101 761 MILITARY TRAFFIC MANAGEMENT COMMAND TRANSPORTATION EN--ETC F/6 15/5
RAIL AND MOTOR OUTLOADING CAPABILITY STUDY, FORT LEWIS, WASHING--ETC(U)
SEP 78 T J LEFEBVRE
UNCLASSIFIED MTMC-TE-78-25 SBIE-AD-E750 089 NL

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engines have dropped off the incoming empty railcars at the empty storage sites E1 through E4 plus temporary empty storage site ET5. The installation's two 80-ton switching engines will spot these empty railcars at the appropriate tracks. There will be three incoming trains of empties and three outgoing trains of loaded unit equipment per 24-hour period.

Loading, blocking, and bracing will be accomplished during daylight hours and is expected to last about 7 hours. The switching operation will follow and will be carried out until it is completed.

The switching operation begins with the arrival of the main line engines at track E1, where 21 empty cars are placed on track E1, 20 empty cars on track E2, 18 empty cars on track E3, and 8 empty cars on track E4. The ML engines then transit to track L1 to pick up 40 loaded railcars, then to track L4 to couple with 25 loaded railcars, for a total of 65 loaded railcars. The main line engines then travel to the main line track and couple with the caboose before departing for the POE. Switch engine 2 had previously picked up the caboose from track E1 and placed it on track 2 to wait until the ML engines had gathered the loaded railcars. It then travels to the main line track and couples the caboose to the train. Switch engine 3, in the meantime, transits to the main line track, where it couples with SL2 after SL2 uncouples from the caboose. The two switch engines pick up 20 empty cars on track E1 and 20 empty cars on track E2 and spot them on track L1. After the brakes have been set on the empty cars on track L1, the two SL travel to track 2, where they uncouple. Switch engine 3 waits at track 2 while SL2 transits to track E1 to pick up the caboose and place it at track 2.

The second train, with 66 empty railcars plus the caboose, arrives about 10 hours after start of the operation (elapsed time). Twenty-one of the railcars including the caboose are spotted on track E1, 20 on track E2, and the remaining 26 on temporary empty storage track (ET5). The main line engines then pick up 12 loaded railcars from track L6, 15 from track L4, and 40 from track L2, for a total of 67 loaded railcars. The main line locomotives then transit to the main line track, where the caboose is attached to the train by SL2. The second train, of 67 loaded railcars plus the caboose, then proceeds toward its POE.

The two switch locomotives couple and transit to track E1, pick up 20 empty railcars, and then to E2 for 20 empty cars. These 40 empty cars are placed on track L2, where the brakes are set. The two switch engines then uncouple. Switch engine 2 moves to track E3, couples with 18 empty railcars, and proceeds to track E4 for 8 more. The 26 empty railcars are then spotted on track L4. After the brakes have been set, SL2 travels to track 2 and waits. During this period SL3 travels to ET5, picks up

26 empty railcars and places 12 of them on track L6. The remaining 14 empty railcars and SL3 wait at track L6 until SL2 moves away from track L4, then SL3 proceeds to track L4 and spots the 14 cars before it travels to track 2.

The third train of empties arrives at the Logistics Center about 13-1/2 hours (elapsed time) after the start of the operation, with 65 empty railcars plus the caboose. Twenty empty railcars, plus the caboose, are positioned on track E1 by the ML engine, 20 on track E2, 18 on track E3, and 7 on track E4. The main line engines then transit to track L5 to pick up 25 loaded railcars, then to track L3 for 40 loaded railcars. The ML engines, with 65 loaded railcars, travel to the main line track, where the caboose is attached to the train by SL2. The last train of loaded railcars then leaves Fort Lewis for its POE at about 15-1/4 hours (elapsed time) after the start of the operation.

The two switch engines couple together after the third train leaves Fort Lewis, transit to track E1 to pick up 20 empty railcars, and then to track E2 for 20 railcars before spotting them on track L3. After the brakes have been set, the two switch engines travel to tracks E3 and E4 to pick up 18 and 7 empty railcars, respectively. These 25 cars are then placed on track L5. The rail switching operation terminates about 17-1/2 hours (elapsed time) after starting, which includes approximately 7 hours for loading and blocking and bracing.

APPENDIX C

SPECIAL-PURPOSE RAILCARS AND LOADING/UNLOADING PROCEDURES

Specially designed railcars, in particular those used for transporting vehicles, can greatly increase the speed and efficiency of a rail outloading operation. Bilevel, trilevel, and integral chain tiedown flatcars are the primary means of enhancing the loadout routine of most military vehicles. Bilevel and trilevel railcars are best suited for the smaller vehicles, including 2-1/2-ton trucks.

The integral tiedown flatcars will accommodate larger vehicles, including tanks. Loading and securing equipment on these railcars can be accelerated to 15 minutes per vehicle, for small vehicles, versus approximately 45 minutes for blocking and bracing procedures used on standard-type railcars. Also, the BTTX 89-foot flatcar has a capacity of six 2-1/2-ton trucks, doubling the single level capacity. Thus, in speed and capacity, special-purpose railcars are an advantage worth investigating.

There are essentially five methods of loading/unloading multilevel railcars, they are:

1. The "K" loader of 463L aircraft cargo-loading system.

2. The forklift and pallet used in conjunction with a crane and/or ramp.

3. The crane and ramp combination.

4. Adjustable ramps.

5. Adjustable built-in ramp on multilevel railcars.

The procedures used with each of the above are described in detail in TM 55-625[6/], as are tiedown procedures.

As of 1970, more than 70 percent of DOD installations had no organic capability to load/unload multilevel railcars. No outloading plans should include the use of these railcars until a thorough investigation verifies

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6/ TM 55-625, Transportability Criteria and Guidance, Loading and Unloading Multilevel Railcars at Military Installations in the United States.

their availability at the time required. The supply of special-purpose flatcars with integral tiedowns is also limited. As a result, even though these types of railcars are very valuable for volume rail outloading operations, their availability is seriously in question unless advance preparations are made.

The following trends in flatcar supply are now operative and have been since the development of modern piggyback service in the mid-1950's:

1. The size of the flatcar fleet has been growing, both in number of flatcars and in relation to the size of the car fleet as a whole. This gain has been confined to specialized cars; for example, trailer-on-flatcar, container-on-flatcar, bilevel, trilevel, and bulkhead flatcars.

2. The size of the general-purpose flatcar fleet has decreased, though average length and capacity have increased.

3. A majority of all flatcars are owned by car companies, not by the railroads. Therefore, more flexibility in assignment, with improved utilization, has resulted. Fewer idle cars available for short-notice use than would be if each railroad maintained an adequate supply for its own needs.

Considering these trends, the sizes of the various components of the specialized flatcar fleet, and the blocking and bracing requirements for the various types of equipment to be shipped by rail, it does not appear prudent to express an installation's needs and outloading plan using only general-purpose flats. The TOFC fleet, in particular, is now most likely large enough to fill military requirements (table 8). The COFC fleet also has expanded to the point that it could carry most of the military's container movements, especially since COFC cars are used almost exclusively for import/export movements, which likely would be greatly disrupted in a mobilization period.

Accordingly, vans or containers should be outloaded on TOFC cars. If the movement is to a port for ocean shipment by other than RORO vessel, the use of COFC cars should be considered. However, the availability of COFC cars in the quantity desired without disrupting civilian container movements is highly improbable.

Other cars in the specialized flatcar fleet generally are assigned to specific services or to a carpool for one shipper's exclusive use. Therefore, although these cars can save blocking and bracing and should be requested when they can be employed profitably in a specific move, the likelihood of obtaining the cars is too weak to base outloading requirement on their use.

TABLE 8
TRAILER TRAIN COMPANY FLEET

Trailer Train Company ownership of selected car types as contained in the April 1976 Official Railway Equipment Register. Trailer Train owns in excess of 95 percent of total US ownership of TOFC, COFC, and autorack cars.

Type	Reporting Marks	Quantity	
TOFC	*TTX	29,661	
	TTAX	5,033	(see also COFC cars)
	GTTX	2,287	
	LTTX	1,876	
	XTTX	733	
	Total	39,590	

Each car has a capacity of two 40-foot (nominal length) trailers. Some can handle one 40-foot and one 45-foot trailer. The XTTX cars also have the capability of transporting three 28-foot trailers.

Type	Reporting Marks	Quantity	
COFC	TTAX	5,033	(see also TOFC cars)
	TTCX	708	
	Total	5,741	

Each car can handle four 20-foot container equivalents. Note that the TTAX cars can handle either containers or trailers and so are counted in both TOFC and COFC totals.

Type	Reporting Marks	Quantity
Bilevels	TTBX	4,333
	BTTX	2,776
	Total	7,109
Trilevels	TTKX	6,133
	RTTX	3,500
	KTTX	2,685
	TTRX	2,196
	ETTX	796
	Total	15,310

*Definitions of Trailer Train Company reporting marks (all are flatcars)
TTX - Equipped with hitches and bridge plates for the transportation of trailers.
TTAX - Equipped with movable foldaway container pedestals, knockdown hitches and bridge plates for transporting trailers or containers or combinations of both. (A = all).
GTTX - Equipped with hitches and bridge plates for the transportation of trailers built by General American Transportation Corporation. (G = general)
LTTX - Low deck (2' 8" or 2' 9" instead of 3' 6"), equipped with hitches and bridge plates. (L = low)
XTTX - Equipped with four hitches and bridge plates for the transportation of two trailers; one 45-foot and one 40-foot or three 28-foot trailers.
TTCX - Equipped with movable foldaway container pedestals for transporting containers. (C = container)
BTTX - Equipped with bilevel autoracks furnished by member railroads. (B = bilevel)
TTBX - Length 89' 4" or over, equipped with bilevel autoracks furnished by member railroads. (B = bilevel)
TTKX - Length 89' 4" or over, equipped with hinged-end trilevel autoracks furnished by member railroads.
RTTX - Length 89' 4" or over, equipped with fixed trilevel autoracks furnished by member railroads.
KTTX - Equipped with hinged-end trilevel autoracks furnished by member railroads.
TTRX - Equipped with fixed trilevel autoracks furnished by member railroads.
ETTX - Equipped with fully enclosed trilevel autoracks furnished by member railroads. (E = enclosed).

Factors affecting the use of specialized flatcars include:

1. First priority for use of general-purpose flats should be to load tracked vehicles and nonstandard wheeled vehicles; for example, artillery.

2. First priority for requesting specialized flats should be for TOFC and COFC cars to load vans and containers, which require very extensive blocking and bracing to move on general-purpose cars.

3. TOFC and COFC cars require no blocking and bracing.

4. Bilevel and trilevel flats will require heavier chains and possibly different hooks to handle other than commercial specification vehicles.

5. Chain tiedown flats may require heavier chains, depending on the loads for which they were designed.

6. Where TOFC cars must be loaded using a ramp rather than side or overhead loading, the number of cars at a ramp should be limited to about 10 because of the delay involved in backing the trailers down the length of the cars and returning with the tractor.

7. Where sufficient suitable aprons and MHE are available, it may be desirable to load containers directly onto COFC cars rather than to place them on bogies and use TOFC cars.

8. If COFC or TOFC cars are not available, some blocking and bracing time and expense can be saved by using bulkhead flatcars to carry containers.

9. Bilevel and trilevel cars require, obviously, bilevel and trilevel ramps or other equipment as indicated in TM 55-625.

10. TOFC, COFC, bilevel, and trilevel cars average 89 feet long. TOFC cars can handle two 40-foot trailers or one 40-foot and one 45-foot trailer. COFC cars can handle four 20-foot container equivalents. Autorack cars can accommodate four to seven vehicles per deck, depending on vehicle length and the number of tiedown chain sets.

11. Tracks used to store or load cars over 65 feet long should be reachable without going through curves exceeding 10-degree curvature, and tracks used for cars between 55 and 65 feet should be reachable without going through curves exceeding 12-degree curvature.

APPENDIX D

COST ESTIMATE

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AFZH-FEB Chocking & Blocking

Chief of Staff DFAE 11 MAY 1977
Mr. Hebert/jr/5025

1. PURPOSE. To respond to CG's notes at Tab A.

2. FACTS. a. In June of 1976 DFAE, in coordination with DIO, DPT and G-4, reviewed the requirements, materials on hand and lead times involving blocking, bracing, tie down and packing and crating necessary to move a division and/or divisional components by rail.

b. The chocking and blocking base data requirements have been stable since the 76 June review and the information collected then is considered valid. Transportation Division was contacted and agreed there has been no significant change in basic requirements. DFAE has increased the stock of materials 10% in the past 10 months.

c. Chocking and blocking materials are required to load out approximately 1100 rail cars for the Division and 100 to 200 cars for attached units. The total blocking, bracing and tie down dollar requirement for the Division and support units is estimated at $663, 000 plus. DFAE currently has on hand $100, 000 of material. This quantity is sufficient to handle the normal moves to YFC or about 275 tanks.

d. To have all rail tie down materials on hand will require an additional $563, 000 plus an additional expenditure of $50, 000 (est) to provide additional storage space. DFAE does not have the funds to purchase additional materials at this time.

3. RECOMMENDATION. It is recommended to prestock 75% of long lead time materials and 50% of patterned material. This would allow sufficient lead time to procure the remaining material at time of deployment without delaying load out dates. The cost to prestock the recommended percent of material would amount to $296, 000. This dollar amount of material is in addition to the $100, 000 now on hand. In order to store the purchased material, additional warehouse space would have to be found in the existing inventory or Bldg 1210 would have to receive a new floor at an estimated cost of $35, 000.

1 Incl
as

JOHN R. MANNING
Colonel, CE
Facilities Engineer

COORDINATION:

Comptroller - Concur________________ Nonconcur________________

DIO - Concur________________ Nonconcur________________

G-4 - Concur________________ Nonconcur________________

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